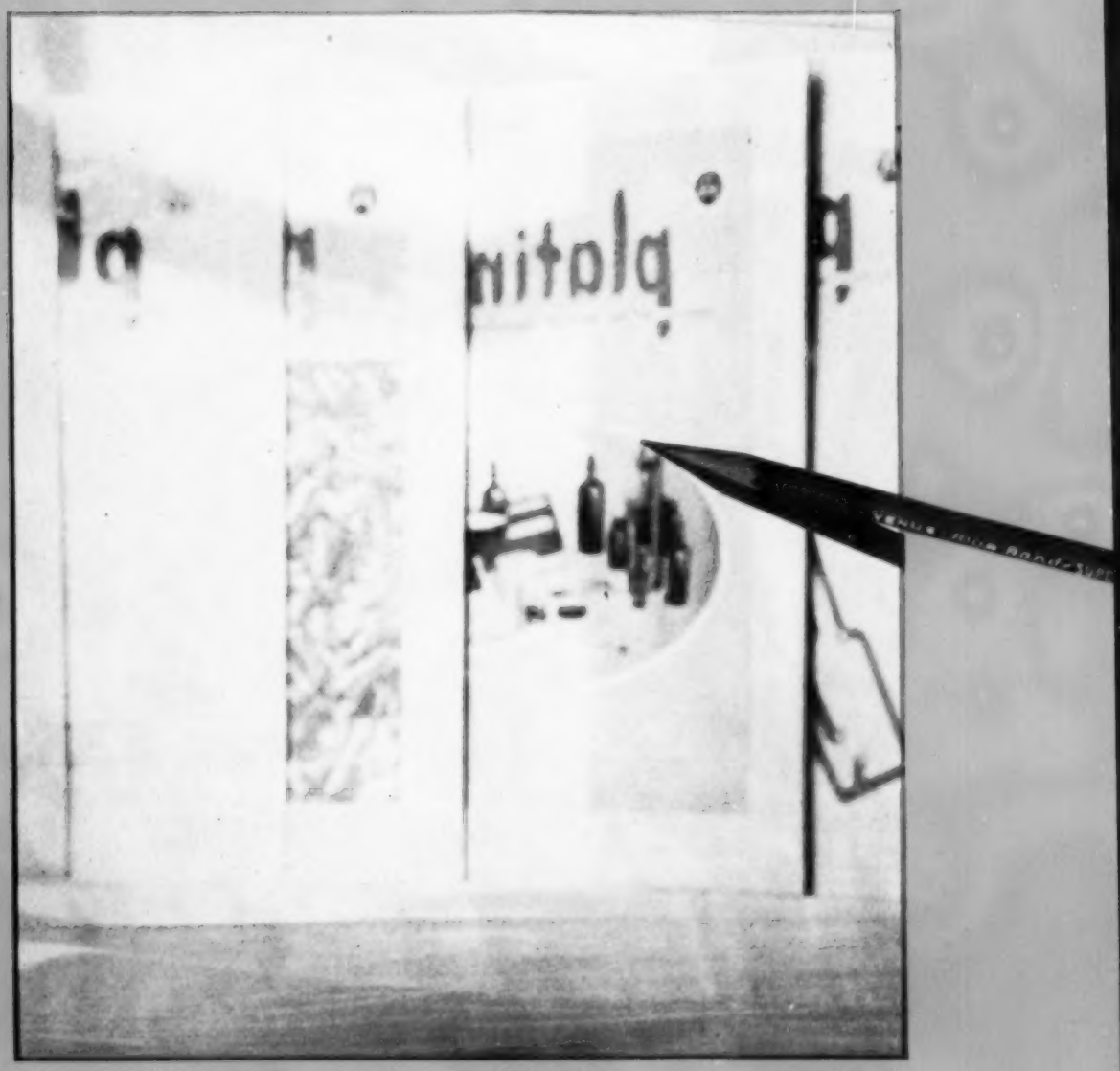
JULY 1955

plating

JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY



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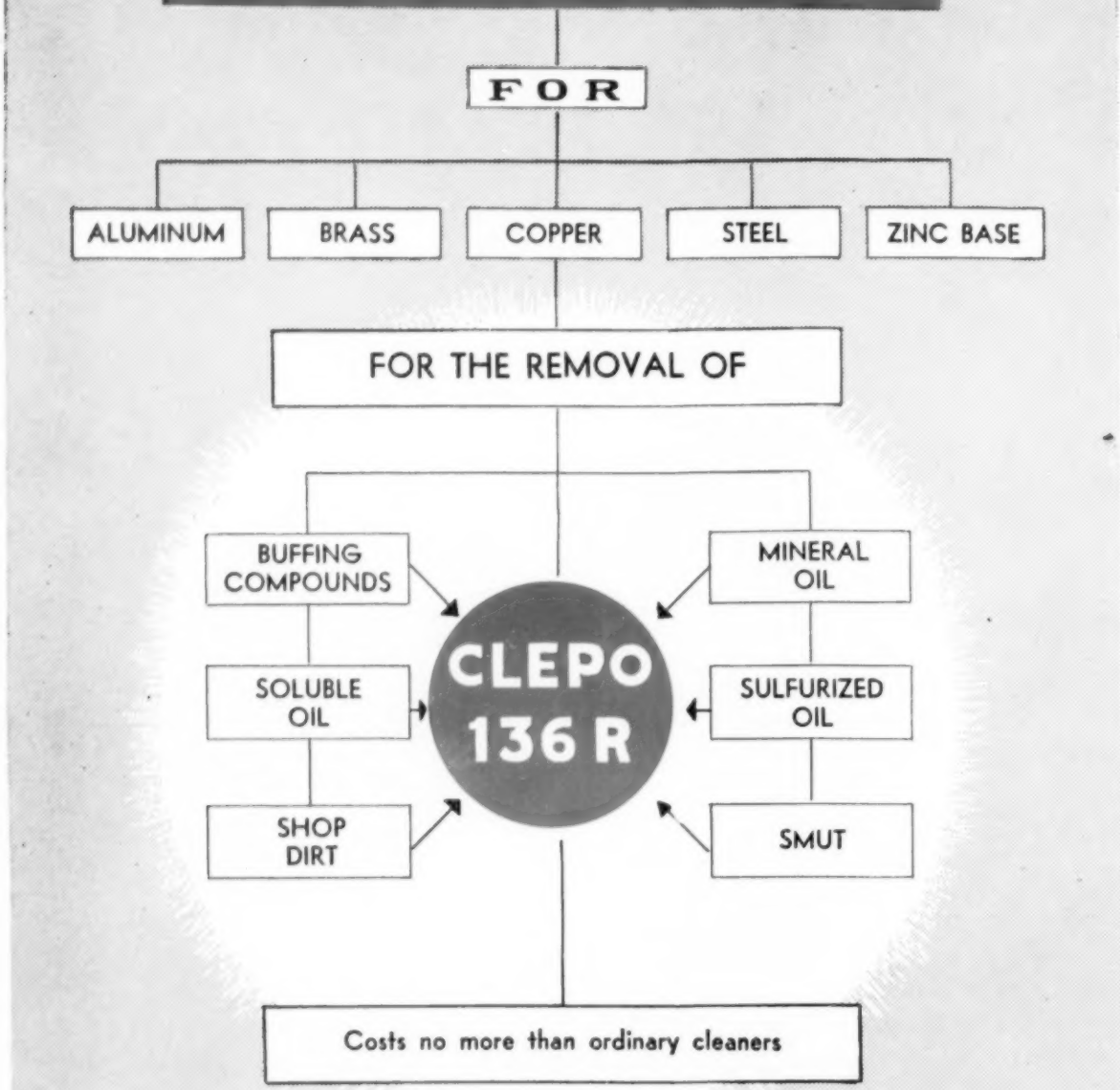

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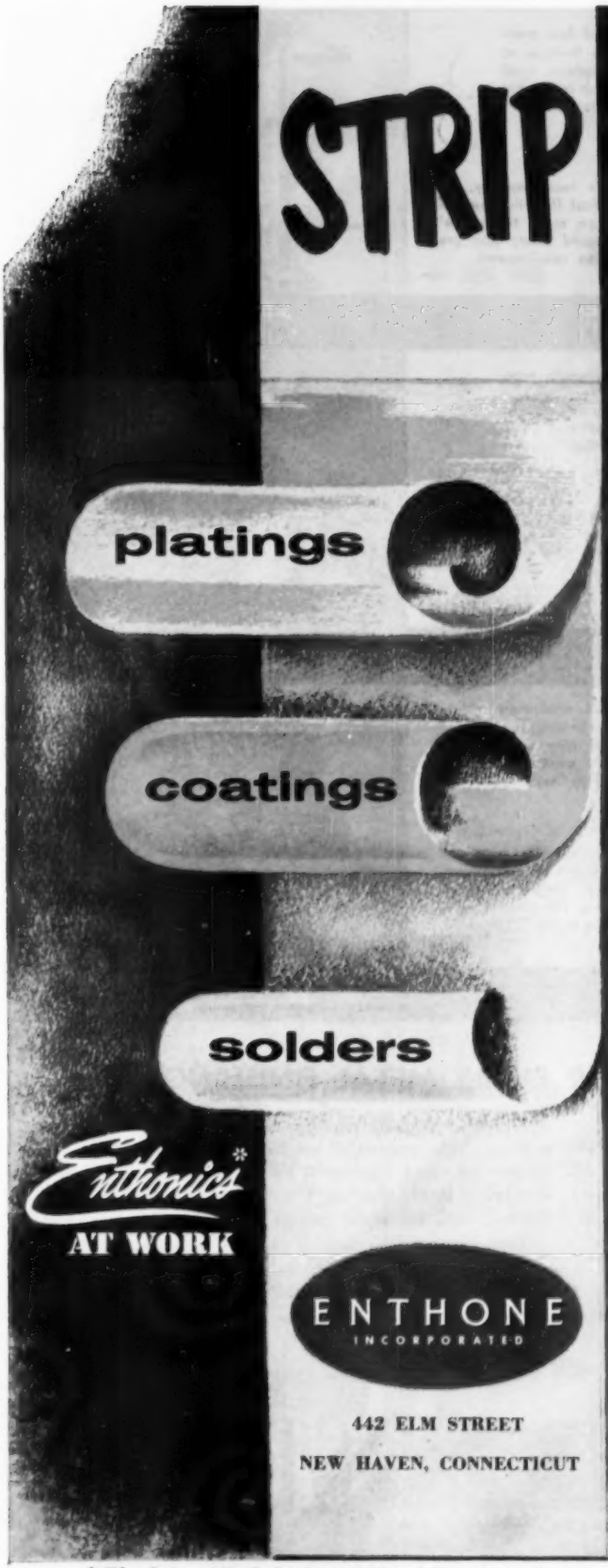

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COPPER or STEEL	and you wish to dissolve tin, lead, or tin-lead coatings chemically, use **ENSTRIP "TL"**, a fast acting, alkaline stripper.
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COPPER ALLOYS	use **ENSTRIP "165-S"**, an additive for acid solutions that will give you quick removal of nickel, tin, zinc, lead or cadmium.
ZINC DIE CASTINGS	use **ENSTRIP "L-88"**, an acid electrolytic stripper for removing chromium, nickel or copper coatings.

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All ENTHONE's metal finishing processes and products, as well as ENTHONE's wide experience in metal stripping, are at the disposal of your company. We welcome the opportunity to be of service to you. Write for literature, without obligation, to —

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** The Scientific Solution of Metal Finishing Problems*

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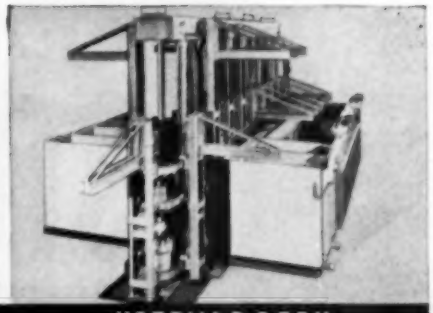
Unit's load capacity, mechanical flexibility and lift design meet tomorrow's increased safety and production requirements.



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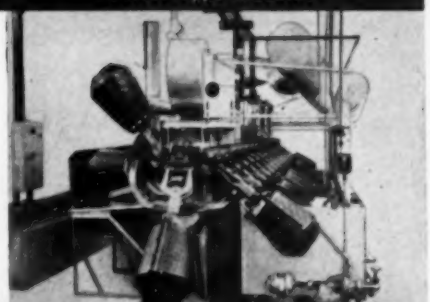

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plating

Journal of the American Electroplaters' Society

July 1955 **Vol. 42, No. 7**

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Editorial . . . 827

Camera Clicks in Cleveland . . . 855

Methods of Conducting Classes for Electroplaters. *Ezra A. Blount* . . . 876

Electrodeposition of Rhodium. *Eduard A. Parker* . . . 882

Cleanability and Oil Spreading Rates. *Henry B. Linford and Paul E. Grubb* . . . 895

The Five Per Cent Salt Spray and its Acetic Acid Modification. *Wardley D. McMaster* . . . 904

AES Directory	926	Equipment and Supplies	863
AES Membership Changes	924	Future Meetings	926
AES News	910	Industry News	830
Article References	908	Patent Abstracts	909
Branch News	915	Personals	840
Classified Advertisements	912	Trade Literature	850
Cover Story	829	Index to Advertisers	925

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Editorial

℞ For Good Public Relations

PUBLIC relations in organizations similar to ours is no different from public relations in the business world.

The science of public relations is not the product of this atomic era: it is as old as Father Time himself. Webster defines public relations as "The activities of an industry, union, corporation, profession, government, or other organization in building and maintaining sound and productive relations with special publics such as customers, employees, or stockholders, and with the public at large, so as to adapt itself to its environment and interpret itself to society."

Techniques and tools of dealing with people are being taught in an increasing number of schools and colleges today. Yet, public relations is so easily attained, so relatively simple, that it is hard to understand why some people make such a difficult thing of it.

Business leaders recognize the importance of public relations and employ trained personnel to improve and maintain good company relations. Management knows, for example, that quality, price and service are important criteria in any business and make for good public relations. More important, however, at times, is the personal relationship between company and customer since statistics prove that two-thirds of all customers are lost due to indifference and not to price, quality or service.

In order to guard against poor impressions—real or imagined—business firms, societies and individuals must continually re-examine their public relations.

In conclusion, if your actions, goods or services are such as to make people want to do business with you, or to make people like you, chances are you are doing an effective public relations job. Good public relations is good "horse sense" and is as simple as that.

P. Peter Kovatis

HONITE Barrel Finishing Produces

Superfine Sanitary Finish!

Cherry-Burrell Corporation, Milwaukee Division, made large savings when they switched to the HONITE Barrel Finishing Method, *and* actually improved the sanitary finish necessary on their line of food processing equipment.

The milk filler tank shown below was formerly finished in two hand operations—grinding to remove weld splatter and generally improve the surface, and polishing to bring the surface down to 15 R.M.S. Recently, Methods Engineer, Ralph Wenger, supervised a change to the HONITE Barrel Finishing Method.

Results? The recommended HONITE procedure eliminated the polishing operation completely, and 60% of the rough grinding hand operation. Finishing time was cut 1½ hours . . . and finishes were improved to a superfine finish.

Your HONITE Methods Engineer or nearby HONITE distributor will show you how *you* can increase production and cut costs, too. Call him today!

Remember, too, the HONITE Division of the 3M Company supplies a *complete line* of abrasive chips, compounds and equipment for every barrel finishing need.

CHERRY-BURRELL METHODS ENGINEER, Ralph Wenger, holds a 40 lb. stainless steel milk filler tank. HONITE Barrel Finishing Method produced its superfine finish.

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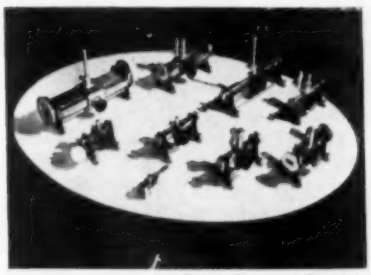
Cover Story

Through the Looking Glass

PLATING'S July cover reflects some of our past issues through the magic of rhodium on glass. Rhodium plated mirrors such as these are indispensible in certain technical fields—second only to silver or aluminum in brightness—second to none in permanence and durability.

Rhodium mirrors are currently being produced by a few highly specialized mirror manufacturers. We are indebted to one of them—Vogeley and Lackman Co., Inc., of New York City for the use of one of their expertly plated masterpieces in helping us to achieve our July cover picture.

The props were set up and photographed by the editor in our Newark headquarters. Doria's biggest problem was the camera angle. He found he was unable to show



Sperry Gyroscope Co. photo

Interior finishes are protected by a bright high-conductivity silverplating covered by Rhodium. Exterior surfaces are finished in black enamel

the pencils point-to-point unless he shot high or wide thus eliminating the PLATING cover reflections almost entirely. He finally managed to "drop" in from the top—came up with the desired result: pencil points touching—covers on parade within.

The mirror measured approximately 12 inches x 12 inches. The Vogeley and Lackman Co. has developed its own rhodium plating process for mirroring, having originally used a process licensed by Sigmund Cohn. The glass is nickeled by evaporation, initially—then electroplated with rhodium.

The pencil in our picture not only brings out rhodium's clarity of reflection but also points up front surfacing's elimination of a double image.

The demand for rhodium mirrors is limited. Optical instrument and camera industries are the most extensive users. Rhodium's most valuable asset, of course, is its imperviousness to atmospheric conditions; it is, for all intents and purposes, tarnishproof.

Rhodium, incidentally, is playing many varied and important roles in our lives today—and is becoming more and more important as we progress technologically. Until recently rhodium was used almost exclusively by the manufacturers of cos-

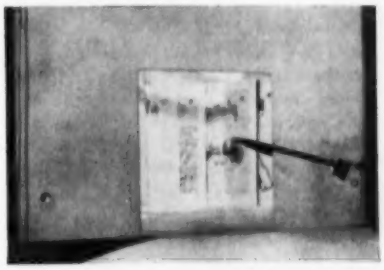
Rhodium plated jewelry looks expensive—sometimes is

tume jewelry. As a plating for these popularly priced gewgaws and ornaments, it is rich and brilliant and remains so indefinitely. For jewelry purposes, less than one five millionth of an inch of rhodium coating is satisfactory and costs less than one cent per square inch.

Today, however, rhodium is the indispensible ingredient in many nuclear mechanisms, in the biggest ships, the fastest planes. Without it, guided missiles might be hit-or-miss affairs, radar extremely unreliable, our ships and planes still in the slow-speed era.

The reason is simple. Rhodium plated conductors through which current passes to make these marvels operate efficiently are virtually foolproof. They remain unaffected by the elements and are always "on the ready" no matter how long they may have been exposed to corrosive conditions.

There are countless other uses for rhodium where corrosion resistance, reflectivity, high temperature or abrasion resistance are the all essential factors. Harder than chromium and able to withstand extremely intense heats, rhodium is now recognized as one of the most useful and valuable metals.



Plating Staff photo

The cover as it appears in the making

We hope our cover mirror, then, will give our readers pause for reflection—with the thought that perhaps out of their reflections will come new and profitable uses for this tough and shiny wonder metal.

James C. Adams

for custom lead work — call

STORTS

STORTS welders in lead have fashioned many thousands of coils, tank linings, fittings, anodes and other lead fabrications. The Storts lead welding specification results in maximum long life utility under severe acid conditions. Storts specializes in high quality lead work for all plating room needs.

42 STONE STREET — STORTS WELDING COMPANY INCORPORATED — MERIDEN, CONN.

Manufacturers of Welded Fabrications to Specification

Industry News

Die's Life in Hot Spot Extended. Use of chrome carbide dies recently for semi-extruding molten soda lime glass flowing at 1800° F in the Providence, R. I., plant of General Electric Company, brought about four immediate benefits. They stretched out die life, reduced costs, cut down inventory and solved the die availability problem.

Used in place of platinum dies inside a furnace operating at 2200° F, the initial Carboloy grade 608 chrome carbide lengthened die life to six months. The second die lasted 20 weeks. In both applications, deterioration of the case, rather than breakdown of the chrome carbide nib, determined the die life.

Cost of the chrome carbide dies, including the nib, casing and labor required for mounting, is about $75.00, compared with a net cost after salvage of $250.00 for the former platinum die.

Die inventory was drastically cut. Chrome carbide nibs now are stocked in two sizes and opened to the required size when needed. Previously, six sizes of platinum dies were stocked, requiring a $8,000 die inventory.

The die availability problem was also solved, since a chrome carbide die can be made in nine hours, against the previous three months time to procure a platinum die.

R-F Controls Renames Manufacturing Division. The American Thermometer Division of Robertshaw-Fulton Controls Company, producer of automatic control devices for home and industry, has been redesignated the American Controls Division. The division is located in St. Louis.

The change of name which became effective May 1, will identify the division more closely with its products, the company said.

Mechaneers Institutes "Toolinglease" Plan. A method of financing tools, dies, molds, jigs and fixtures described as new to the tooling industry, has been announced by Mechaneers Inc., Bridgeport, Conn. Copyrighted as the "Mechaneers Toolinglease Plan," it allows a manufacturer to save capital investment and avoid long term amortization through long or short term leasing of equipment.

In addition to conserving operating cash, the plan has obvious tax advantages and reduces risk involved in outright purchase of tools for unproven manufacturing ventures. The plan can be negotiated with or without purchase options.

New Research Lab. For National Carbon. Dr. Robert G. Breckenridge, who joined National Carbon Div. of (UCC) in mid-April of this year has been named head of their new extensive research plant. He received his B.S. and M.A. degrees at Cornell University, and his Ph.D. degree in Chemical Physics at Massachusetts Institute of Technology. Although only 39 years of age, he already has a broad background of experience and illustrious accomplishment. Since April 1949, Dr. Breckenridge has been Chief, Solid State Physics, U. S. Bureau of Standards, Washington, D. C., and was Head of Physics, Office of Naval Research. This organization is said to have done more to support basic science during the years between the end of the War and the founding of the National Science Institutes than any other group.

Breckenridge

The new National Carbon Research Laboratories will be of one-story construction containing approximately 175,000 square feet of floor space. The main Laboratory building is located almost in the exact center of a 66-acre plot, and is designed around six rectangular module units, each of which contains 20 modules in two groups of 10 each.

Supplementing units are architecturally correlated buildings containing the Chemical Engineering and Laboratory Furnace areas, machine shop, dispensary, cafeteria, locker rooms, boiler and compressor room, administrative, clerical and business offices, storage garages and stock rooms.

To cost several million dollars for ground improvements, buildings, equipment and furnishings, the new Laboratory will accommodate a possible staff of approximately 200 research personnel, in addition to the clerical staff and service personnel.

First Industry-Owned, Operated Nuclear Research Reactor—American Machine & Foundry Company has completed plans for the building of the first nuclear reactor to be owned and operated by private industry for research in industrial and humanitarian fields, it has been announced by General Walter Bedell Smith, Vice Chairman of AMF's Board of Directors.

A number of leading industrial concerns have been invited to participate in the program on a cooperative basis. Meetings to implement the program are now in progress. In addition to building the reactor, AMF will be one of the participants in the program.

Precision Transformer Corp. Adds Saturable Reactor Division. Precision Transformer Corporation, Chicago, announces a new Reactor Division devoted exclusively to research, design, and manufacture of saturable reactors, in sizes up to 500 KVA, single and three phase.

This Division will work very closely on load control problems with manufacturers and users of electric furnaces, plating, rectifiers, motor starting equipment, milk pasteurizing, and X-ray equipment.

Pioneers in the manufacture of air-cooled transformers, PTC has opened the Reactor Division to continue extending new engineering developments and achievements to firms requiring precision service.

Transferred. M. H. Palm, Superintendent at Wagner Electric Corporation in Edwardsville, Ill., has been transferred to St. Louis, Mo. His new address is Wagner Electric Corporation, Large Motor Division, 6400 Plymouth Ave., St. Louis, Missouri.

The new Superintendent at Edwardsville is F. H. Maas.

Graver Sales Rep. H. R. Fosnot, sales manager of Graver Water Conditioning Co., New York has announced the appointment of the Allen-Shuff Corporation of Memphis and Nashville as sales representatives. Their territory will include all of eastern Arkansas, northern Mississippi and western Tennessee from the Tennessee to Mississippi Rivers.

Allen-Shuff will handle Graver's complete line of Industrial, Municipal and Industrial Waste treatment equipment.

W. Harwell Allen, Vice-President and General Manager, Charles F. Almand, Memphis Branch Manager, and Stephen J. Wilkie, Sales Engineer bring to Graver a background of experience in the power plant and water conditioning field that will be of value both to the organization and to its customers.

Allen-Shuff is located at 1121 Church Street, Nashville 3, Tennessee.

International Rectifier Corporation of El Segundo, California, announced the appointment of the E. W. McGrade Co., Kansas City, Mo., as their exclusive sales representative in Kansas, Missouri and Southern Illinois. Representing E. W. McGrade Co. in sales and customer relations efforts for all International Rectifier Corporation products to both distributor and original equipment manufacturers will be: Ted McGrade and J. W. Lane at E. W. McGrade Co., 213 W. 75th St., Kansas City 14, Missouri; and Herbert W. Balmer at E. W. McGrade Co., 1110 S. Brentwood, St. Louis, Missouri.

To Plate Without A Hanging Hull Cell
Is Like Sailing A Ship Without A Compass!

Stop Guessing—Get Your HANGING HULL CELL *Now!*

THE HANGING HULL CELL UNERRINGLY POINTS OUT TROUBLES RIGHT IN YOUR PLATING PRODUCTION CYCLE!

From . . . The Meter . . .

- Average operating current density.
- Current variation throughout the tank.
- How to locate poor anode contacts.
- How to distribute anodes.
- Proper current for making laboratory Hull Cell tests in your plating range.

- Progress of the plating process at any given time—including Full Automatics.
- Effects of agitation in production.
- Effects of temperature in production.
- Overall performance of the entire finishing operation (Buffing, Cleaning, Plating), including sequence plating such as copper, nickel, chrome. The panel can be examined at any desired point.
- Bright plating range and effect of impurities.

From . . . The Test Panel . . .
(Steel or Polished Brass)

THE NEW MODEL HANGING HULL CELL GIVES QUICK CHECKS OF YOUR BATHS!

Catch costly plating troubles at the source—right at the plating tank! Use of the Hanging Hull Cell for plating control is simplicity itself. Just suspend the cell on the cathode busbar (as you hang a rack of work), and daily spot checks are made with almost no time or effort. Adaptable to any type of still or automatic plating, the Hanging Hull Cell is invaluable in locating trouble through a sequence of operations. Test plates are the same size as used in the 1000 ml. Hull Cell and are available in either zinc plated steel or polished brass.

•

Meter—50 amperes, 4½" scale, 100% reversible (for reverse cleaners). Standard length—24" or 32" from hook center to cell bottom. (Other lengths on special order.) Hook size—Hook furnished for work rod up to 1½" in diameter.

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☐ Please enter our order for ..... Hanging Hull Cell(s) 24 or 32 inch length complete with 100 zinc plated steel, 10 polished brass panels and instructions at $97.00 each f.o.b. Rocky River, Ohio.

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Industry News

Sewage Sterilization by Gamma-Radiation Being Studied. The deadly radiation from radioactive substances, already serving mankind in industry, agriculture and medicine, may be put to other beneficial uses according to investigations conducted by the Corps of Engineers' Research and Development Laboratories, Fort Belvoir, Va., in conjunction with the Oak Ridge National Laboratory at Oak Ridge, Tennessee.

After six months of research, sanitary engineers have demonstrated that waterborne sewage can be sterilized by gamma-radiation without activating or leaving residual radiation in the treated liquids.

The waste products from atomic power plants offer one possible source of the required radioactive materials. According to Harry N. Lowe, Chief of the Engineer Laboratories' Sanitary Engineering Branch, the possibility exists that these waste products can be used to sterilize water, sewage and other liquids. Work is continuing to fully exploit other possible benefits.

Besides the possible use of gamma-radiation by the Corps of Engineers for the sterilization of sewage other agencies have found that gamma rays can also be used to sterilize certain drugs and antibiotics which are harmfully affected by heat, to preserve meat and other food stuffs by killing the bacteria that cause spoilage, to irradiate pork and thus inhibit the spread of trichinosis and to decrease the number of bacteria in swimming pools without using chlorine.

Rustproof Scaffold Produced on Automatic Machine. American Plating, Inc. is now electroplating all scaffolding for Universal Manufacturing Corp., Zelienople, Pa., world's largest producer of tubular steel scaffolding.

"Never before in the history of scaffolding have all the component parts been electroplated," says B. W. Carbeau, General Manager of American Plating. The result is that for the first time a virtually rustproof scaffold is now on the market.

A new, automatic rotary plating machine, capable of handling produces as large as 12 ft x 6 ft x 2 ft, enables the Zelienople plating firm to give all Universal's "Ezebilt" scaffolding its protective metallic coating.

Federated Metals Appointed Exclusive Agent for Incar Plating Chemicals. Federated Metals Division, American Smelting and Refining Company, has been appointed exclusive agents for a line of plating chemicals manufactured by Incar, Inc., Cleveland, Ohio. It has been announced Incar will produce and service the chemicals, while Federated's Plating and Electrochemicals Department will arrange for distribution through leading plating supply houses. The new line of chemicals will supplement Federated's present plating anode business which includes copper, zinc, cadmium, tin, lead, including the well-known Conducta-Core, brass, silver, flattop, and other nonferrous anodes.

Technical Sessions Highlight May Meeting

Technical sessions highlighted the May 4-6 meeting of the Investment Casting Institute, held at the Park Sheraton Hotel, New York.

Among the subjects covered were "Development of Specifications Applicable to Investment Cast Metals" by Charles Yaker, Chairman of the Institute's Metal Specifications Committee; "Outline of Recommended Melting Practices for Small Heats" by Dr. Nicholas J. Grant, Massachusetts Institute of Technology; "Gating, Sprueing, Risering," by Howard F. Taylor, Massachusetts Institute of Technology; "Standard Test Bars for Investment Castings" by B. W. Duncan, Chairman of the Institute's Physical and Non-Destructive Testing Committee; and "Proposed Investment Casting Design and Drafting Manual" by E. G. Chapman, Chairman of the Institute's Dimensional Tolerances Committee.

The afternoon portion of the technical sessions was devoted to talks by W. A. Dubovick, Chairman of the Institute's Process Materials Standards Committee, who spoke on "Test Methods and Specifications for Process Materials;" Dorian Shanin of Rath and Strong, who reported on "Quality Precontrol of Investment Casting Production;" and James H. Moore, Vacuum Metals Corporation, who spoke on "Vacuum Melting—Possible Tool for Investment Casters."

As part of the business sessions of the Institute meeting, K. J. Yonker, Misco

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THE SEYMOUR MFG. CO., SEYMOUR, CONN., U.S.A.
The spotlight is on a distinctive new shipping carton for Seymour Bright Nickel solutions!
Designed and adopted for your convenience, it gives you these welcome advantages:
● A compact, easy to store carton of crush-resistant fibreboard, which YOU DON'T HAVE TO RETURN!
● A convenient, four-bottle package which offers you easy to handle and economical one gallon containers amply packed in a single carton.
● Quick identification of each of Seymour's famed Bright Nickel and Brightener solutions in neat, clean cartons.
Next time you order Bright Nickel solution . . . ask for Seymour — in the package with the sunburst and band design!
SEYMOUR
THE SEYMOUR MFG. CO.
SEYMOUR, CONN., U.S.A.

Industry News

Precision Casting Co., reported on "Methods of Estimating Investment Casting Costs," while V. S. Lazzara, Casting Engineers, Inc., reported on "Study and Discussion of Typical Investment Casting Cost Estimates."

Other reports were made by Institute President Red Operhall, Misco Precision Casting Company; K. M. Bartlett, Thompson Products, Inc.; V. S. Lazzara, Casting Engineers, Inc.; R. D. Gumbert, Alloy Precision Casting Company; Louis Brooks, Jelrus Precision Casting Company; and Harry Dolan, Executive Secretary of the Institute.

Trinks Award Goes to Three Outstanding Engineers. Three men, who have made important contributions to the science of industrial heating and to its application in national defense were recipients on May 9 of the industry's top honor, the Trinks Industrial Heating Award, at a banquet sponsored by the Award Committee in the University Club in Pittsburgh.

The three honored, all engineer-executives, were Horace Drever, president, Drever Company, Bethayres, Pa.; C. E. Hawke, vice president, The Carborundum Company, Niagara Falls, N. Y.; and Walter H. Holcroft, executive vice president and technical director, Holcroft & Company, Detroit, Michigan.

The award is bestowed annually by a judges' panel of industrial heating authorities, among candidates nominated by the industry, for outstanding contributions to industrial heating. It was established in honor of Dr. Willibald Trinks, professor emeritus of Carnegie Institute of Technology, and world authority on industrial heating problems.

New Sarco Sales Agent. H. L. Simmons, president of Sarco Company, Inc. announced that on March 14, Hoffman & Hoffman Company succeeded the Royster H. Johnson Company as their sales representative in North and South Carolina.

Sarco and Sarcotherm are leading manufacturers of steam traps, temperature regulators, heating specialties and Sarcotherm weather compensated control systems.

The new Sarco sales representative, Hoffman & Hoffman Company, has sales offices in Greensboro, N. C., Raleigh, N. C. and Columbia, S. C.

Little Barrel for Small Parts. The Marlane Development Company, Inc., New York, N. Y. is pleased to announce that it has just been appointed East Coast distributor for the Dawson-Riedel Chromium Plating Barrel—a product of the Dawson Corp. of Pelham, N. Y. Marlane will be responsible for all sales and technical servicing in this area.

The recently developed Chromium Plating Barrel, capable of bulk chromium plating small parts, is now being marketed by the Marlane Development Co., Inc., New York, N. Y. This is one of the first successful chromium plating barrels to be marketed in the United States. It will handle approximately 10 lbs of work per 10 minute load, or 50–60 lbs per hour. The barrel is capable of either bright finishing over a bright nickel base, or hard chrome plating, directly on steel. It is especially aimed at the manufacturers of nuts, bolts, screws, watch parts, hardware, and other small items.

Atlas Consolidates Darco Operations. Consolidation of all Darco activated carbon operations into Atlas Powder Company's chemicals division was announced by Edward J. Goett, Atlas vice president responsible for chemicals activities.

Previously, Darco had functioned as a separate department of Atlas, with a plant at Marshall, Texas, and sales headquarters in New York City. Early in March, the sales headquarters were transferred to the Atlas general offices in Wilmington.

All Darco sales activities now will be handled by a group in the chemicals division's sales department in Wilmington, with Dr. H. J. Fornwalt as group manager.

E. W. Harris, formerly director of sales for the Darco department, has been appointed a special representative in connection with Darco sales activities. He will continue to work out of New York City.

Through its Darco operations, Atlas is one of the leading producers of activated carbons in the United States.

The only filter on the market you can LEARN TO OPERATE IN ONE MINUTE!
CLEAN COMPLETELY IN LESS THAN 15 MINUTES!
Sel-Rex
DOUBLE DUTY FILTERS
Cuts filter cleaning time to less than 15 minutes
No filter on the market can be completely cleaned and reassembled as fast as a Sel-Rex DOUBLE DUTY Filter.
The entire Annular element is secured to the tank cover—lifts out freely and easily for cleaning, either by hand or with the sturdy, hand-operated davit mounted on the tank of larger units. Messy handling of wet and dirty elements is eliminated—you can even clean an element used for carbon treatment without soiling your hands!
Other outstanding advantages:
Completely new Sel-Rex designed mechanical seal pump sharply reduces maintenance. Pump seal replacement method has been simplified.
The compact design saves valuable shop space ... the new Annular element gives DOUBLE the amount of filtration area and speed in the same space required by other filters. All Sel-Rex DOUBLE DUTY Filters can be used with either the new Annular element or porous stone—no additional parts are required for conversion.
Standard models from 250-18,000 GPH capacity.
Larger models built to specification.
So simple to operate — You can learn to perform ALL filtering operations in less than ONE minute—precoat ... filtering ... backwashing ... or liquid transfer – even if you've never operated a filter before. Simplified, easy-to-read instructions are fastened to the front of the tank – can be read when operating valves are used. Valves are conveniently located, colored and numbered for quick identification.
WRITE TODAY FOR ADDITIONAL INFORMATION OR QUOTATION
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BART-MESSING CORPORATION
229 Main Street, Belleville 9, New Jersey

THE NEW UDYLITE BRIGHT NICKEL PROCESS
514
1. IMPROVED LEVELING
2. WIDER BRIGHT PLATE RANGE
3. EXCELLENT DUCTILITY
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WORLD'S LARGEST PLATING SUPPLIER

THE
Udylite
CORPORATION
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We would like to discuss 514 Bright Nickel Process with your sales representative. Please have him call.

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COMPANY _____

STREET _____ ZONE _____

CITY _____ STATE _____

Industry News

R-F Wins Award. The first annual Alexander Hamilton Free Enterprise Award for service in public relations has been awarded to Robertshaw-Fulton Controls Company's Grayson Controls Division, Long Beach.

The award is for "the best year-round public relations job in pointing up the advantages of America's free enterprise system," and is presented as a high light of the annual observance of Invest in America Week.

Thomas H. Pender, director of public relations and advertising for Robertshaw-Fulton's Grayson Division, accepted a plaque symbolic of the award at a "Free Enterprise Day" breakfast sponsored by the Los Angeles Junior Chamber of Commerce. Y. Frank Freeman, of Paramount Pictures, who is chairman of this year's Southern California observance, made the presentation before a group of Chamber members, civic leaders and Stock Exchange members.

Runner-up to Robertshaw-Fulton for the grand prize award was Santa Fe Railway, which won a special award of merit. A panel of Los Angeles news media and public relations executives judged the competition.

Invest in America Week (April 25–May 1) was started five years ago as a "reminder that we must guard against those forces that seek to undermine our free enterprise system," and has since spread to all parts of the country.

Improved Service for Metropolitan New York Laboratories. Improved delivery service to laboratories in Metropolitan New York, including parts of Westchester County and New Jersey, has been announced by Meyer Scientific Supply Co., Inc., Brooklyn, New York, according to David Spiess, president.

He attributed the improved service to an effective coordination of plant facilities, personnel effort and contract for regular pickup and delivery by United Parcel Delivery.

Spiess cited as ideal for laboratory supply house operation, the single story Meyer plant which, he said, "eliminated many delays in the handling of goods from storage to the shipping department. In the Meyer Plant," he explained, "there is a straight line movement of material without delays incurred by waiting for elevators or climbing stairs.

"To further speed service," he continued, "we have located our shipping room adjacent to a drive-in area. Delivery trucks come in under our roof, regardless of weather, and are loaded without delays caused by parking and other common loading problems.

"The least of our problem in expediting local orders," he concluded, has been the coordination of employee effort. Every one of them is a shareholder as well as a worker for better company service."

Hewitt-Robins Goes Dutch. A new subsidiary company has been established in Holland by Hewitt-Robins Inc. of Stamford, Conn., according to an announcement today by Harold Von Thaden, vice president and general manager of the parent company's International Division. The new subsidiary will be known as Hewitt-Robins (Netherlands) N. V. and will be located at 57 Von-Delstraat, Amsterdam.

guard against Rejects

"Sealed-Disc" Filters were designed especially for plating rooms. They're smaller, compact, and more portable than ordinary conventional Filters, and they are also performing satisfactory results on many acid dips, electro cleaners and solvents.

You can be sure with a "Sealed-Disc" Filter

More and more cost-minded platers depend on Alsop *"Sealed-Disc"* Filters to remove dirt, dust, and sludge from their plating solutions. They get better finished plated work, they save time and labor, and their plating solutions last longer. The *"Sealed-Disc"* Filter assures positive, trouble-free performance that's proof against even the invisible impurities that cause nodules and porousness, proof against rejects and reworking. There's a *"Sealed-Disc"* Filter *"to fit your job"*—write for complete information, the Alsop Engineering Corporation, 1007 Fine Street, Milldale, Connecticut.

ALSOP ENGINEERING CORPORATION

Filters, Filter Discs, Pumps, Tanks, Mixers, Agitators

AES SUSTAINING MEMBERSHIP PROGRAM

Three more progressive firms have joined the AES research effort through the important medium of the Sustaining Membership program. The new firms are:

(firm and city)	(Branch credit)
Arkansas Metals Company, Chicago, Illinois	Chicago
General Motors of Canada Ltd., Oshawa, Ontario	Western Ontario
Rawac Plating Company, Springfield, Ohio	Dayton
Number of Sustaining Members supporting AES research through this month	315
Number of Sustaining Members through last month	313

DETROIT 11, MICHIGAN

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PRECIOUS METAL

"PLATEMATES"

Sel-Rex BRIGHT GOLD PROCESS

Add "Sales Appeal" to your products... without increasing your manufacturing cost! Here is the only Bright Gold Process that offers unlimited use —both decorative as well as functional. Produces a rich, mirror-bright surface that is *hard* and *corrosion resistant* without *scratch brushing* or *buffing*. Requires no special equipment and operates at room temperatures.

Sel-Rex "Silvrex" BRIGHT SILVER PROCESS

Another great Sel-Rex contribution to better, more economical precious metal plating. "Silvrex" is a crystal clear solution that produces a mirror-bright deposit without scratch-brushing and buffing. A one addition agent brightener that contains no sulphur or other impurities. The electro deposit is extremely ductile. Bath is simple to make up and to maintain. Wide range of current density.

Sel-Rex BRIGHT RHODIUM PROCESS

The swing is to rhodium... and first choice is the Sel-Rex Bright Rhodium Process! Our process produces a brilliant, fine grain deposit that combines hardness, high reflectivity and excellent resistance to corrosion. Sel-Rex Bright Rhodium is particularly ideal in the optical, jewelry, electrical and electronic industries.

Sel-Rex SILVER SOL-U-SALT

Only Sel-Rex Silver plating is a ONE-STEP process! Sol-U-Salt is a water soluble, crystalline cyanide salt containing 54% metallic silver. Add it directly to the bath — for either solution make-up or maintenance. Calculating, mixing and filtering are eliminated. Completely pure — reagent grade quality at technical grade price.

Try a trial order or write for complete literature.

Sel-Rex PRECIOUS METALS

SEL-REX PRECIOUS METALS, INC.

229 MAIN STREET · BELLEVILLE 9, N. J.

Developers and manufacturers of bright precious metal plating processes.

Visit our Display Booths 323-326-327 at the Industrial Finishing Exposition.

Industry News

Synthane Corporation Begins Construction on Eighteenth Addition to Oaks, Pa. Plant. Synthane Corporation, manufacturer and fabricator of thermosetting laminated plastics for industrial use, has started construction of a new wing to their plant at Oaks, Penna.

The new building will house the automatic screw machine department and provide increased facilities for lacquering, moistureproofing and fungicidal treatment of various grades of sheet stock, rods, tubes and fabricated parts. Relocation of the screw machines will make available much needed space for the production of copper-clad laminates, the basic material in the manufacture of printed circuits.

To meet the ever-increasing demand for foil-clad laminates in electronic devices, radio and TV sets, Synthane plans to make this department the most advanced in the laminated plastics industry.

The new building is the eighteenth major plant expansion since the original factory was built in 1929.

Progress in Atomic-Power Depends Upon the Development of Metals able to withstand severe punishment by radiation, heat, and corrosion in atomic power reactors, a nuclear scientist of Sylvania Electric Products Inc. reported.

Dr. Henry H. Hausner, engineering manager of Sylvania's Atomic Energy Division, told a Diamond Jubilee meeting of the American Society of Mechanical Engineers that many "vexing" metallurgical problems are being investigated in the development of efficient and economical metals for nuclear reactor design. Four metals playing the most important role in atomic power reactor operation, are uranium, thorium, beryllium, and zirconium.

Uranium and thorium are fuel materials, and beryllium is an excellent moderator, the Sylvania scientist pointed out. Defining a moderator, he said reactor control is easiest when fission takes place at heat-producing energies rather than at the higher radiant energies such as produced by an atomic bomb. In an atomic reactor, the moderator is a material that slows down the speed of atom-splitting neutrons to the desired heat-producing energies. Zirconium, he added, can be used as a cladding material for the prevention of corrosion.

A cladding, he pointed out, acts as a container for the fuel element. It must be efficient at transferring heat, and provide the fuel a corrosion-resistant seal against the surrounding cooling material. It also functions to prevent the escape of radioactive products into the coolant stream.

He said powder metallurgy offers many advantages in the fabrication of nuclear reactor components. As an example, he said that by means of powder metallurgy, fabricators can change the grain structure of metals, "thus introducing into the structure a higher degree of disorder and making the metal more resistant to radiation."

Buckeye Appoints Baker Distributing Company. Charles Wise, Secretary of the Buckeye Products Company, Cincinnati, announces that the Baker Distributing Company, 1105 W. 11th St., Cleveland, will carry the complete line of SPEEDIE Buffing and Polishing Compositions in the Greater Cleveland and Toledo areas. Long known in metal finishing circles in these two prominent Ohio cities, the Baker Distributing Company is well qualified to present the diversified SPEEDIE Buffing Compounds to all buffing and polishing plants. For quick deliveries, stocks will be maintained in the Cleveland warehouse of Baker Distributing Company.

Major Revision in Stainless Steel Designations. The first major changes since 1952 in the published designations for stainless steel types were announced here today by American Iron and Steel Institute. "These changes," according to Richard E. Paret, stainless steel specialist for the Institute, "are the result of improved industry practices and elimination of certain governmental controls. They now assure users even greater uniformity and dependability in these special requirement steels," Paret pointed out.

Standard types of stainless steels are numbered in the 300 and 400 series for the convenience of steel makers and users—to simplify their specification of these heat- and corrosion-resistant steels. The last change in published designations was made in August 1952, largely to comply with NPA orders to restrict the use of critical alloys.

Nice Product, Nice Package

Folks often wonder why we spend an extra ¼¢ a pound out of our own pockets for a lithographed drum. Fact is we're proud of the quality of BFC Chromic Acid and figure it deserves a bright, colorful container.

Every batch gets checked against a tough quality spec. Off-grade acid goes on the dump. Only top-quality material goes into those shiny BFC drums. Send us a modest order and see for yourself.

BETTER FINISHES & COATINGS, INC.

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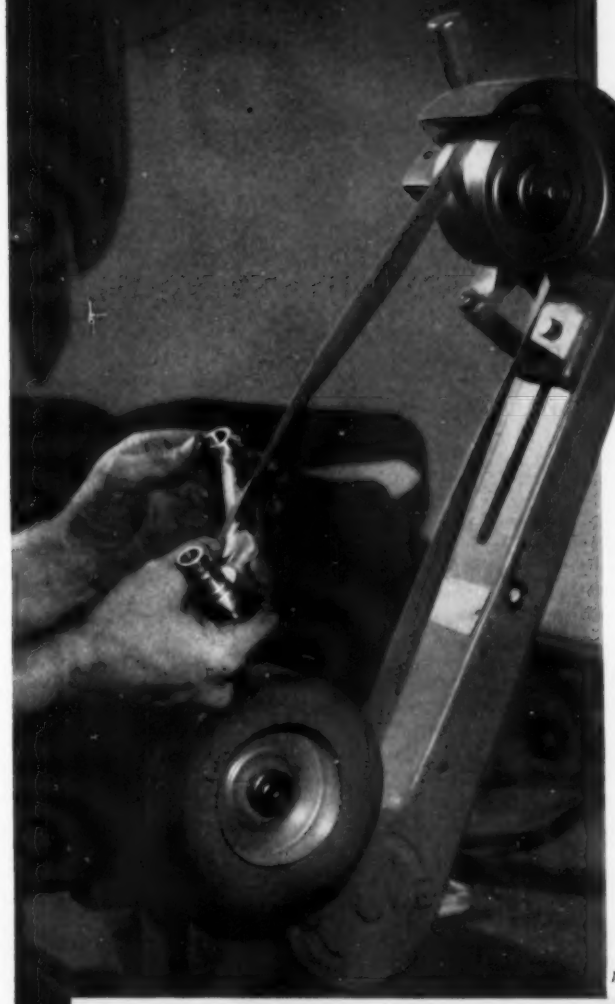
BFC

You can spot productive hands by the company they keep!

Boost contour polishing with Behr-Manning abrasive belts!



WITH THESE MODERN COATED ABRASIVE applications on hand, you can produce superior finishes on tricky contours at record breaking speeds. The combination of flexible, even-cutting BEHR-MANNING abrasive belts and up-to-date methods make this possible. Test them on your parts — in your plant or in a nearby BEHR-MANNING Demonstration Room.

Write for the Production Digest Bulletin. Contains 60 pages of detailed data on coated abrasive grinding and polishing techniques. Address Behr-Manning, Troy, N. Y., Dept. PL-7

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Model CN-2 made by Engelberg-Huller Co., Syracuse, N. Y.

A favorite for dry fining and blending plumbing parts.

Smoothing the way to finer finishes on flat areas.

Tops for removing flash from difficult inside contours.

G-4

BEHR-MANNING® *division of NORTON Company*

▲ COATED ABRASIVES ▲ SHARPENING STONES ▲ PRESSURE-SENSITIVE TAPES

Personals

Appointment of **Robert J. Koll** as plant manager of Diamond Alkali Company's Greens Bayou Plant at Houston, Tex., was announced by **Loren P. Scoville,** general manager of the firm's Chlorinated Products Division.

Replacing **Henry S. Curtis,** who has resigned, Koll takes over his new post with a background of 15 years experience in the chemical industry. Koll graduated in 1940 from Case Institute of Technology, Cleveland, with a B.S. degree in chemical engineering.

He joined the Diamond organization in 1945 as a development engineer, and was named solvent plant superintendent at Diamond's Deer Park Plant near Houston in 1950. Two years later, Koll was promoted to technical manager of the Deer Park Plant. For the past year he has been engaged in handling special technical problems for the Chlorinated Products Division.

Prior to joining Diamond, Koll had been associated as a development engineer with Rohm & Haas Company and the B. F. Goodrich Chemical Company. Koll is a member of the ACS, American Institute of Chemical Engineers, Sigma Xi, and Beta Theta Pi.

Promotion of **Dr. William J. Lightfoot** to the position of chief staff engineer in Diamond Alkali Company's Central Engineering Department was announced by **C. C. Brumbaugh,** director of engineering.

Dr. Lightfoot joined the Diamond organization in July 1952, as a development engineer, and since then has been engaged in atomic energy and soda ash research projects. At his new post, he will be responsible for economic studies, process flow sheets, and staff work in Diamond's Central Engineering Department.

Dr. Lightfoot was educated in Cleveland schools and earned his B.S. and M.A. degrees in chemical engineering from Case Institute of Technology, and a Ph.D. degree in chemical engineering in 1943.

Formerly assistant professor at Penn College, Dr. Lightfoot also has been a process engineer with the Great Lakes Carbon Company and the Glenn L. Martin Company. He later joined the engineering staff of the H. K. Ferguson Company as a consultant.

A member of the ACS and the American Institute of Chemical Engineers, he also has been elected to Sigma Xi and Tau Beta Pi, honorary scientific fraternities.

Diamond Alkali Company announced the promotion of three veteran engineering executives to new posts. **George V. Dupont,** chief staff engineer of the central engineering department, has been promoted to manager of manufacturing operations for Diamond Black Leaf Company, to carry on the manufacture and marketing of Black Leaf pest-control products. He was graduated in 1934 from Purdue University with a B.S. degree in chemical engineering. He joined Diamond in 1940 and since then has served the company in various engineering capacities. Dupont is a member of the Cleveland Engineering Society and Alpha Tau Omega social fraternity.

Robert C. Sutter formerly chief group engineer has been named assistant director of engineering. He joined the Diamond organization in 1940 shortly after graduation from Penn College with a chemical engineering degree, and is a member of the American Institute of Chemical Engineers.

Edward J. Loeffler, Jr. succeeds Sutter as chief group engineer. He assumes direction of a staff of 35 engineers, draftsmen and clerical personnel handling major engineering assignments for Diamond's Painesville plant. An engineering graduate of Rice Institute, Loeffler has been a design engineer with Diamond since June 1947. He is a member of the ASME.

Hugh C. Land will succeed **William P. Drake** as head of the Pennsylvania Salt Manufacturing Company's Industrial Chemicals Division. Drake recently was named executive vice president when president **George B. Beitzel** announced plans to retire later this year upon completion of 25 years' service with the company.

As general manager of this major operating division, Land will direct both production and sales activities. These include four plants and ten sales offices which produce and distribute a diversified line of heavy chemicals for use in virtually every basic industry.

Land received his B.S. degree in chemical engineering at the University of Denver in 1938. His first association was with the A. S. Horner Construction Co. During the war he served for four years with the U. S. Chemical Warfare Service as maintenance chief of the Rocky Mountain Arsenal.

Joining Pennsalt in 1946 at the company's Wyandotte, Mich. works, Land served successively as field engineer, maintenance and construction engineer, and assistant superintendent. He was transferred to the Philadelphia executive offices in 1949 to become assistant to the production manager, whom he succeeded in 1950. In 1954 he was named manager of manufacturing of the Industrial Chemicals Division.

Land belongs to numerous professional and industrial organizations and is active in the civic affairs of the Drexel Hill community in which he and his family reside.

Edward W. Sloan, Jr., Cleveland industrial and civic leader, was elected to the board of directors of Cowles Chemical Company at Cowles' annual shareholders' meeting.

Sloan

Sloan's election increases membership of the board from five to six, according to **R. F. Huntley,** Cowles president. Other directors re-elected at the meeting, in addition to Huntley, were **C. C. Bassett, W. M. Clossey, C. B. Lansing** and **D. A. Gaskill.**

Plans for further expansion and diversification were confirmed by Huntley, who pointed out that Cowles' first quarter sales this year were 5.5 per cent ahead of the same period last year.

Sloan is also vice-president, treasurer and a director of Oglebay Norton and Company. He is a director of Central National Bank and Jack and Heintz, Inc., and holds executive posts with St. James Mining Company and Pine Ridge Coal Company.

He is president of Mayfield Country Club and a trustee of University School. He attended both Yale and Western Reserve Universities—graduating from Reserve in 1929.

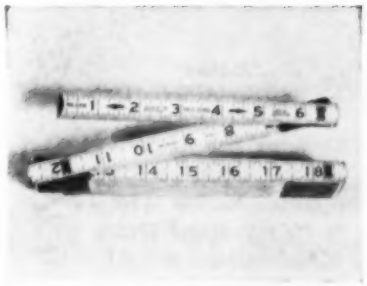
John F. Shea, vice president in charge of sales, of the Becco Chemical Division, Food Machinery and Chemical Corporation, announces that **Eric A. Hansen,** manager of the New York territory of the company, has retired as of April 1, 1955 to devote full time to his own business enterprise in Florida.

Albert L. Shutts, who has been Hansen's assistant for a good many years, is now in full charge of sales and customer service operations in the New York territory. He will be assisted by **Edward M. Roth, Jr.,** who is being transferred from the Buffalo home office to the New York City office at 420 Lexington Avenue, New York 17, N. Y.

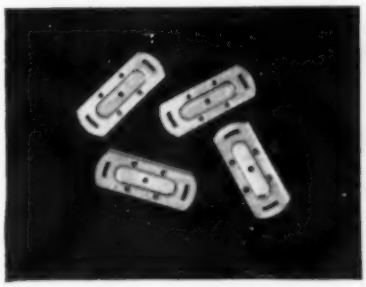
Roth, a graduate of Canisius College, joined Becco Chemical Division in 1936 and has been a member of the research and development department staff. More recently, Roth handled research and customer service work connected with the use of sodium perborate and other specialty peroxygen compounds, stabilization and dilution of hydrogen peroxide and physical chemistry of peroxygen compounds generally.

Better luster, savings in time and money are reported by Lufkin Rule Co. as a result of switching to BURNEK 22. Above, barrel is emptied after burnishing operation. Lufkin also uses Wyandotte 444-C, brush-on paint stripper, to salvage steel tape.

How to get brilliant luster at lowest cost



Here is a typical rule which has brass spring joints — made at Lufkin Rule Co.



These are the spring joints which are used on the rule pictured above. Note luster.

Use Wyandotte's Burnek 22, says Lufkin Rule Co., Saginaw, Mich. Here's why:

A continuous search. The Lufkin Rule Company burnishes all brass spring joints on its rulers before their final assembly. In a continuous effort to improve the results of the finishing operation, the company had tried a wide range of burnishing compounds, including soap chips, but without sufficient success to meet their standard of quality. Recently they switched to Wyandotte's BURNEK 22.

Change for the better. "BURNEK 22 gives us better luster than we've been able to get with any other product," says Divisional Superintendent J. H. Farmer. "And it dissolves completely . . . faster. Rinsability? Excellent! It's easy to get really clean parts with BURNEK 22."

Burnishing costs have been substantially cut at Lufkin Rule because, they report, BURNEK 22's easy rinsing and solubility have saved time and money. They use less water for rinsing. And a little BURNEK 22 goes a long way!

A call that will pay. If you're looking for ways to improve your metal cleaning or finishing operations, call your Wyandotte representative today. Wyandotte products are research-developed and production-proved to give you the best results . . . at lowest use-cost. *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, Calif. Offices in principal cities.*

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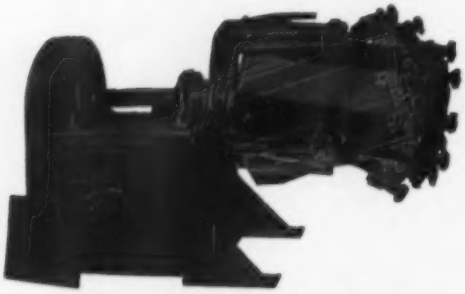
CHEMICALS
J. B. FORD DIVISION
SPECIALISTS IN METAL-CLEANING PRODUCTS

USE "RELIANCE" PRODUCTS FOR

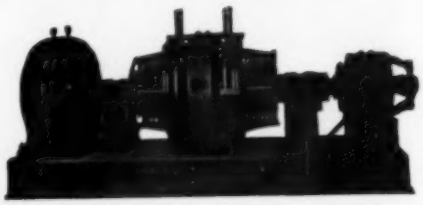
ECONOMY : EFFICIENCY : DEPENDABILITY

LET US SUPPLY YOUR NEEDS FOR YOUR PLATING OR POLISHING DEPARTMENT

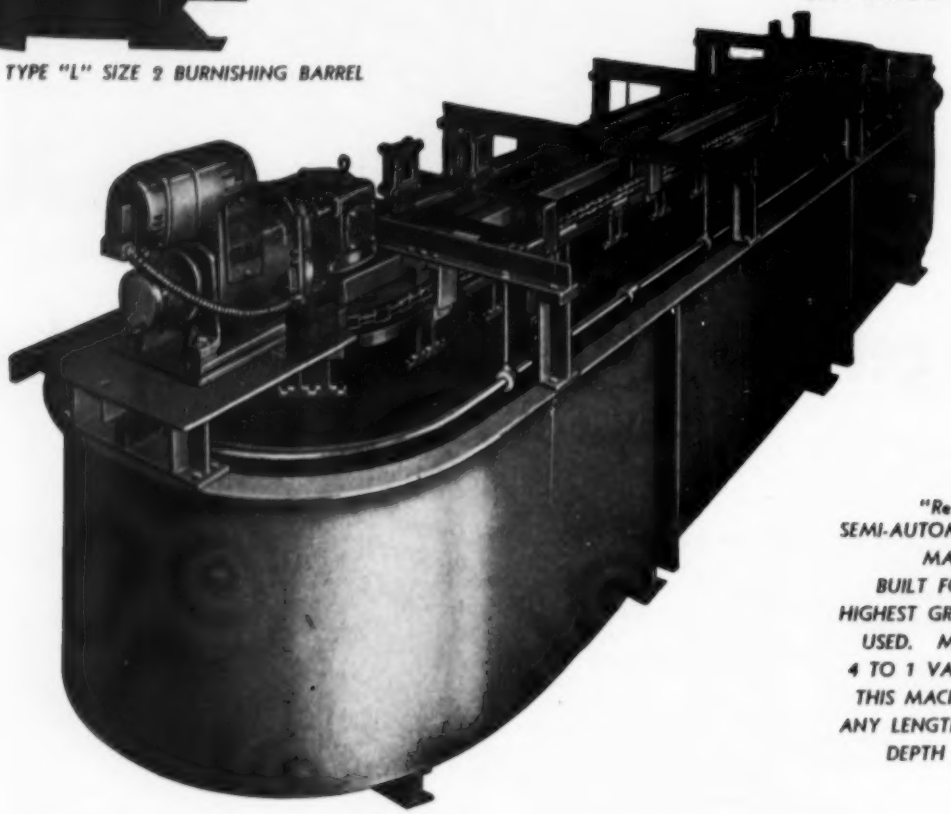
WRITE FOR FURTHER DETAILS



TYPE "L" SIZE 2 BURNISHING BARREL



3000 AMP. 6 VOLT GENERATOR SET



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BUILT FOR SERVICE
HIGHEST GRADE MATERIAL USED. MOTOR ½ HP
4 TO 1 VARIABLE SPEED.
THIS MACHINE IS BUILT ANY LENGTH, WIDTH AND DEPTH OF TANK.

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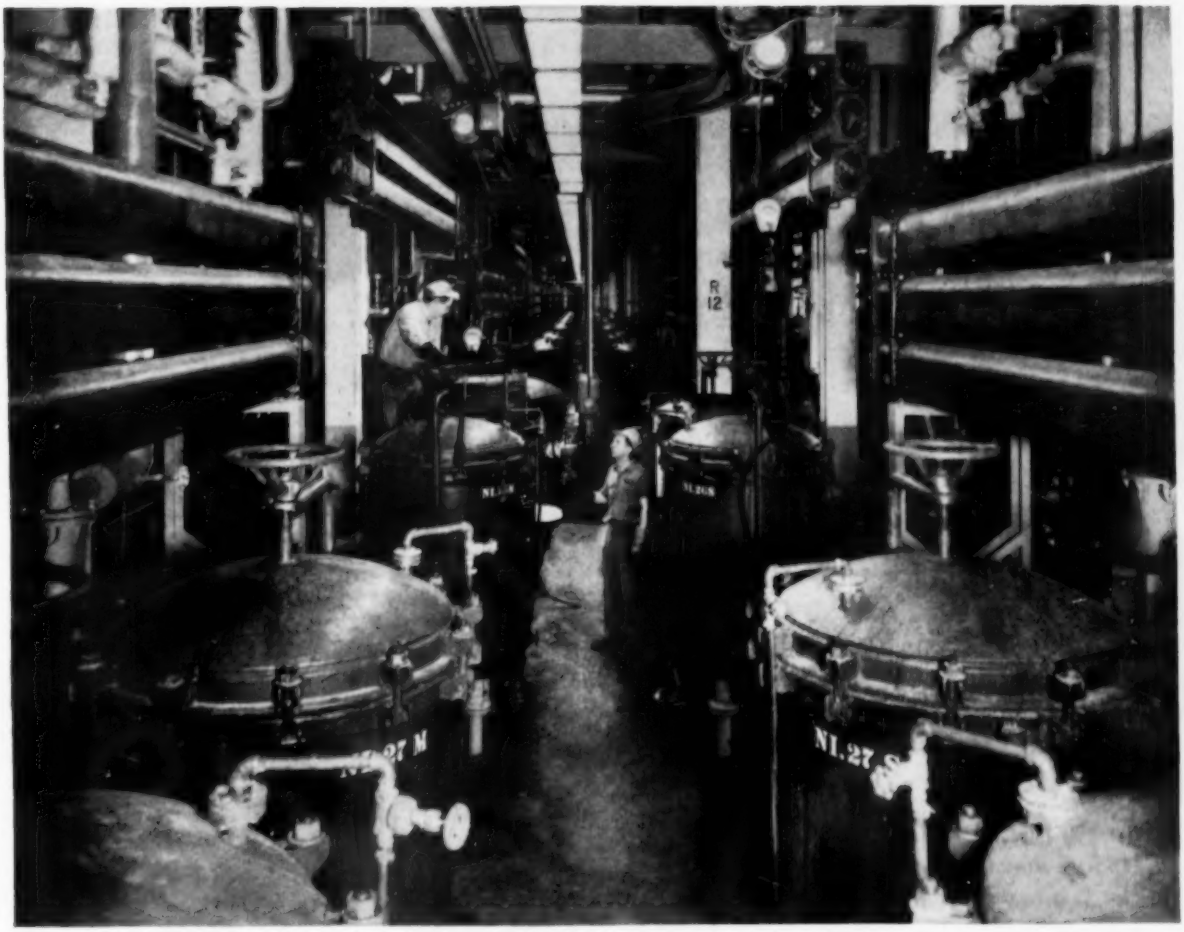

48 Sparkler Horizontal Plate Filters in this installation

Why do the largest plating plants in the world Choose SPARKLER FILTERS?

The answer is simple, and obvious to plating engineers.

First — the cake on a Sparkler Horizontal plate filter will not crack or fall off with a variation in pressure or with a complete shut down of filtering. ***Second*** — dry cake disposal eliminates the sewer problem. ***Third*** — the quick-change plate assembly reduces the down time for cleaning each filter to a matter of minutes.

This is why many of the world's largest plating plants use Sparkler Filters exclusively.

Plating engineers can get full cooperation at Sparkler on any size installations.

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Filtration engineering and manufacturing has been our exclusive business for over 30 years

Manufacturing plants in Canada, Holland, Italy, Australia

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where New England turns for reliable service on

Rectifiers

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- Pennsalt Metal Cleaners
- Chandeysson Generators
- Pennsalt Fosbond and Fos Process
- Crown Rectifiers
- Heil Heat Exchangers and Chemical Resistant Tanks
- Columbia Ammeters and Rheostats
- Daniel Plating Barrels
- Meaker Plating Machines
- Stutz Plating Barrels
- Republic Lead Anodes

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Distributors of Industrial Chemicals
Makers of
Luster-on,® Pla-Tank® and Stripode

Write for our new Metal Finishing Catalog

80 WALTHAM AVE., SPRINGFIELD 9, MASS.

Personals

C. K. Skinner, manager (manufacturing, announced the appointments of **H. M) Norton,** supervisor, commercial service and **H. C. Jenseth,** plant manager of the Plainville plant of General Electric's Distribution Assemblies Department.

Norton will be responsible for the administration of all commercial service activities at the Plainville plant. He was graduated from public schools at Chicopee and Springfield, Mass., and later attended Harvard Engineering School. He has held a number of technical and administrative posts in the electrical industry. Prior to his present appointment, Norton was a district sales manager, supplies and apparatus, for the General Electric Supply Company, Hartford, Conn.

Jenseth has been with GE since 1945. He was appointed service engineer with the GE service shop at Seattle, Wash., in 1947; manager-sales engineering 1954; plant manager of the San Francisco plant 1954. He was graduated from the University of Washington with a B.S. degree in mechanical engineering. He is also a graduate of the General Electric Test Engineering Program.

Also announced was the appointment of **Robert G. Page** as manager of the Maspeth plant. Page has been associated with GE since 1948. He has held the position of supervising engineer, switches and circuit breakers for the Trumbull Components department. As a result of his efforts in the development of a new type of circuit breaker for the U. S. Navy in 1950, he was presented the coveted Charles A. Coffin award, the General Electric Company's highest recognition for employee accomplishments of outstanding merit. He was graduated with a B.S. degree from Bowdoin College in 1941.

Gordon J. Berry, president, The Electric Products Company, Cleveland, announces the appointment of **G. J. Doss** as manager of marketing. He will be responsible for the coordination of sales and promotion of all divisions of the company.

Doss came to The Electric Products Company in 1946 as manager of the Cleveland District Office and in 1951, was advanced to assistant sales manager. In 1953, he was appointed general manager of Electric Product's Switchboard and Control Division. He brings to his new position a broad experience in electrical sales and engineering.

Seaporcel Metals, Inc., manufacturer of architectural porcelain enamel, announced the appointment of **Frank B. Gibson** to the post of vice president in charge of production.

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1—5000/2500 AMPERE, 6/12 VOLT, **CHANDEYSSON,** 25° C., Synchronous, Exciter-in-head.
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1—2500/1250 AMPERE, 8/16 VOLT, **ELECTRIC PRODUCTS,** Synchronous, Exciter-in-head.
1—2000/1000 AMPERE, 9/18 VOLT, **ELECTRIC PRODUCTS.**
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1—500 AMPERE, 25 VOLT, **CHANDEYSSON,** Synchronous, Exciter-in-head.
1—400 AMPERE, 40 VOLT, **M. G. C.,** Exciter-in-head.

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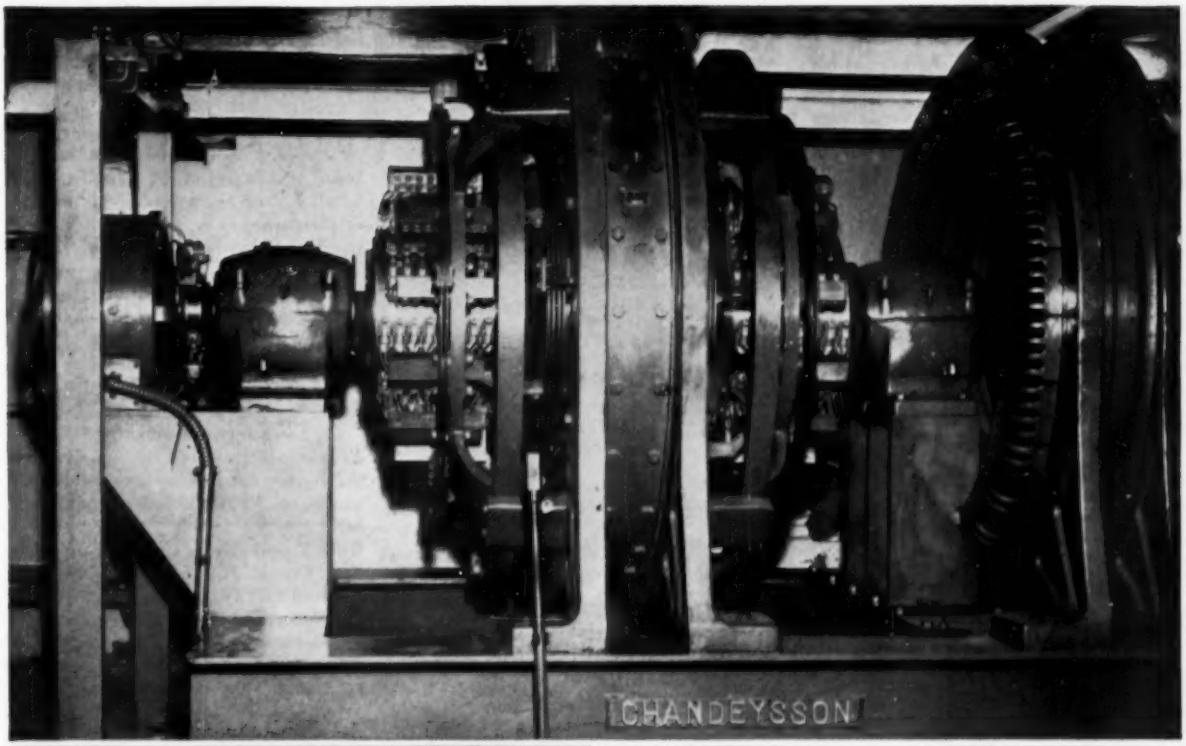

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4. **Enjoy Lifetime Power Dividends** . . . sustained, lifetime overall constant efficiency as high as 85% does not decrease with age or overload.

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Personals

Dr. Harold M. Sonnichsen, director of the technical division and a member of the board of directors of Permacel Tape Corporation, has been named a vice president of the corporation, it was announced by the New Brunswick, N. J., manufacturers of industrial and consumer pressure-sensitive tapes.

Dr. Sonnichsen is a graduate of Texas Western College and holds both M.S. and Ph.D. degrees from Harvard University. He came to Permacel Tape in 1944 from the E. I. DuPont Company.

Dr. Sonnichsen is a member of the ACS, American Institute of Chemists, American Society for the Advancement of Science, and Sigma Xi Honorary Fraternity.

Belke Manufacturing Company announces that **Frank Marshall** has joined the Belke Sales Organization and will cover Wisconsin and Northern Peninsula of Michigan.

Marshall has an extensive background in metal fabrication and finishing.

Dr. William L. Faith, deputy director and chief engineer of the Air Pollution Foundation since the organization's formation a year ago, was elected vice president and chief engineer of the Foundation's board of trustees on March 23.

The Air Pollution Foundation is an independent scientific research organization, with headquarters at Los Angeles, Calif. It was established and is financed by individuals, organizations, and corporations for the purpose of determining the causes of smog and implementing its elimination.

Dr. Faith, 47, was graduated from the University of Maryland with a B.S. degree in 1928, took his M.S. degree from the University of Illinois in 1929, and his Ph.D. degree in 1931.

He is a member of the ACS, American Institute of Chemical Engineers, Sigma Xi, Alpha Chi Sigma and Phi Kappa.

He is the co-author of "Applications of Chemical Engineering," 1940; "Industrial Chemicals," 1950, and "Laboratory Design," 1951.

Two new directors of the Udylite Corporation are announced by **Leon K. Lindahl,** chairman of the board.

One of these new directors is the Honorable **George Edward Bushnell,** Sovereign Grand Commander of the Northern Masonic Jurisdiction of Scottish Rite Masons. Previously, Judge Bushnell was the Chief Justice of the Supreme Court of Michigan having been first elected a Justice of that Court in 1933. He brings to the Udylite board of directors wide business experience gained in the practice of law.

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Excellent cutting action. This development of Norton's famous ALUNDUM abrasive cuts fast, clean and cool — ideal for polishing jobs ranging from roughing to finishing.

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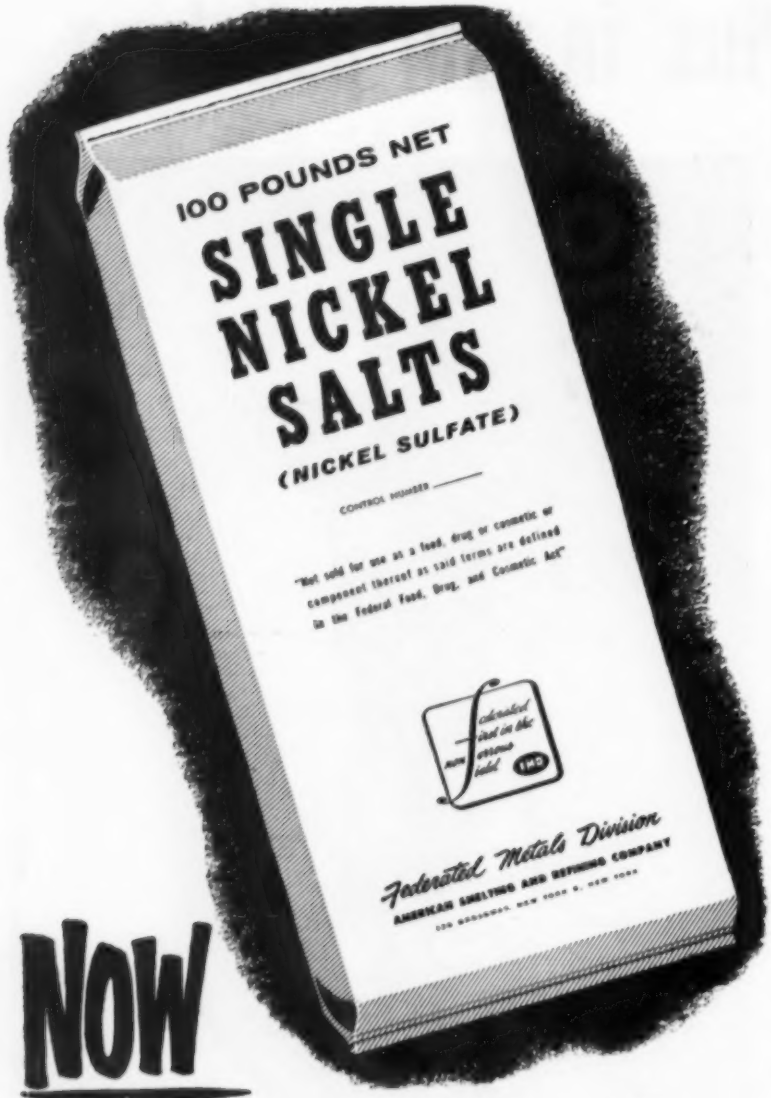
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Personals

Lawrence F. Boland, sales manager of The Beryllium Corporation since 1952, has been named to the newly created office of vice president in charge of sales.

Boland, who became associated with the firm in 1935, previously served as a sales correspondent, production control chief, and production manager.

An alumnus of Catholic University, Washington, D. C., Boland is a member of the National Sales Executives Club, the American Ordnance Association, Society for Advancement of Management, American Arbitration Association, and Copper and Brass Warehouse Association.

In addition to creating and filling the new post, The Beryllium Corporation directors re-elected four officers. They are: **Matthew J. Donachie,** president; **William D. Gamon,** vice president; **Richard M. Quimby,** secretary and assistant treasurer; and **Walter R. Lowry,** treasurer and assistant secretary.

Dr. Francois J. Olmer, who specializes in research in the fields of electrochemistry and physical chemistry, has been promoted to senior chemist, highest professional position at Armour Research Foundation of Illinois Institute of Technology, Chicago.

Olmer, 43, joined the Foundation as a research physical chemist in 1952 after being in charge of special development work for the Celanese Corporation of America, Summit, N. J., during 1948–52.

While at the Foundation, he has worked on such projects as the detection of ozone in the atmosphere, development of pigments for pressure-sensitive papers, demineralization of water, and deicing of aircraft.

Olmer, who received a Ph.D. in physics from the Sorbonne of the University of Paris, is the author of a book on ferromagnetic oxide, published in 1940 in France. He also has published a number of papers and holds eight patents on the improvement of chemical processes and new fibers.

He is a member of the American Chemical Society, American Physical Society, Electrochemical Society, and the Société Chimique of France.

Olmer and his family reside at 33 Green Bay Road, Highland Park, Ill.

Reelection of **John A. Frink** as president and treasurer of Mechaneers Incorporated, Bridgeport, Conn., at the annual meeting of the company, has been announced. The company, designers and builders of tools, dies and special machinery, is instituting a profit-sharing plan of compensation for employees, unique in the tool industry.

● To electroplaters and plating department heads in every section of the nation, the name ARco is symbolic of broad engineering knowledge . . . advanced methods and equipment . . . bringing top plating results.

Corrosion-resistant ARco rubber coverings are applied to tanks and accessories, Diaphragm Systems, Parts Separators, Air Agitation Systems, Grids and Screens, Ventilation Equipment, Pipes and Fittings, Materials Handling Equipment. For expert advice on economical, efficient rubber applications to electroplating equipment, call on ARco engineers. Their help is offered to you without obligation.

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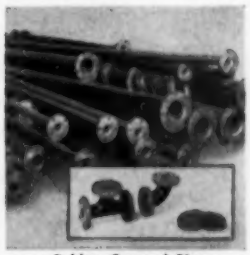

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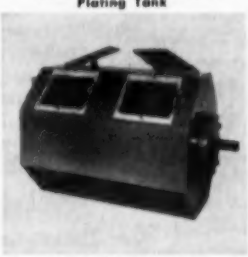

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Trade Literature

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L—700. Film on Coated Abrasives—"Coated Abrasives Belts Speed Metal-working Production" is a 27-minute sound-and-color close-up (104 application scenes) of the newest finishing developments in the fast moving coated abrasives technology. The methods, machinery and product applications shown will give the viewer an up-to-date problem and solution session aimed at cutting finishing cost per piece. Applications range from off-hand contour and standard lathe work but concentrate mostly on semi-automatic and automatic operations. Work materials include ferrous, nonferrous and nonmetallic; shapes include contour, cylindrical, flat and sheet products. Prepolishing techniques are strikingly demonstrated. Film prints (16 mm, sound, color, 27-minutes) are available to foremen groups, plant production training classes, technical societies and college engineering and trade school groups.

L—701. High-Impact Styrene Sheet—Auburn Button Works Inc., Auburn, N. Y., announces a four page technical bulletin describing its high-impact polystyrene sheet now available in widths to 51 inches, mat or high-gloss finish. The sheet can be custom-extruded in any length, up to 3/16 inch in thickness, with unlimited color possibilities. The company extrudes the sheet, but is not engaged in vacuum-forming of products from the material.

L—702. Liquid Chiller—The flexibility of the Acme Flow-Therm liquid chiller for air conditioning, heat pump and industrial liquid cooling applications is emphasized in a new catalogue announced by Acme Industries, Inc. Major components of this factory assembled unit are matched, in the exact capacity needed for efficient and economical performance, to the make and size of compressor used in the system. Single and dual circuit are included in a wide range of capacities, from 15 through 300 tons. In addition to its flexibility, simplification of engineering and more accurate job estimating by architect, consulting engineer or contractor, economical installation and operating costs, and space-saving compactness are among the advantages of the Flow-Therm.

L—703. Evaporative Condensers—A new design in evaporative condensers is explained with a cut-away illustration and full construction details in a new catalogue now available from Acme Industries. The new line, with capacities ranging from 10 through 150 tons at 78° wet bulb, features a new external sump and flush-type, anti-splash air inlet. Sump has been located outside the unit for easy servicing—contains water treatment basket, sediment screen and an automatic waste-drain-and-overflow, all reached by simply lifting a cover. All sections of the unit are formed of steel and hot-dip galvanized after fabrication for maximum protection against rust. Centrifugal blowers to induce a quiet, constant velocity air stream, with or without ducts, and all-prime-surface refrigerant coils are incorporated in the new line, as they were in the previous series of Acme Evaporative Condensers. Included in the catalogue are performance curves for selecting units to use with either freon or ammonia.

L—704. Recording Recordall—12-page bulletin gives facts and figures on new laboratory recorder that converts *manual* laboratory instruments into automatic, *recording* instruments. Importance: does away with need for expensive models.

Name: the Fisher Recordall. It records changes in potential, current, resistance, temperature, *p*H, pressure, vacuum, rotational speed, illumination, transmittance, reflectance.

Bulletin is FS-251; available without charge.

L—705. Ge Diodes—The Semi-Conductor Division of International Rectifier Corporation announces the availability of new literature, "Bulletin GD-2", listing ratings and specifications on Germanium Diodes. This bulletin describes International's complete germanium point contact diode line. It offers specifications on the High Temperature Diodes, Computer Diodes, UHF Mixer Diodes, Meter Protection Diodes and General Purpose Diodes. A complete interchangeability and replacement chart is also included in this literature.

L—706. Thermocouples and Pyrometers—A new edition of their 56 page Bulletin P1238 on thermocouples and pyrometer accessories has just been published by The Bristol Company of Waterbury, Conn.

The bulletin, a Buyers Guide and User's Manual, contains extensive engineering data on the selection and installation of the proper types of thermocouples, wells, head assemblies, and other pyrometer accessories, as well as recommended thermocouples for specific installations in the chemical, metal-working, iron and steel, ceramic, petroleum, food, and glass industries, and many others.

L—707. Lab Review—*LANCO* Apparatus Review No. 5, published by Arthur S. LaPine & Company, Chicago, Ill., describes and illustrates 1954's best sellers in the line of laboratory apparatus. A separate 4-page section shows 43 items of polyethylene labware, and a 2-page section is devoted to stainless steel labware.

Other equipment described includes: atom models, balances, glass beads, acid bottle carriers, glass-blowing burners, laboratory carts, portable bath coolers, Electrothermal tapes, portable melting furnaces, hot plate—magnetic stirrers, heating mantles, multiple plug-in controls, pH papers, rotary air pumps, instrument shields, sinks, stirrers, safety cylinder supports.

L—708. Market Research—Should you market that new product? Where should you locate that new plant? Who are the potential users of this product? Is your market saturated? These are the types of questions which are discussed in Foster D. Snell, Inc.'s new twelve-page booklet, "Marketing and Economic Research . . . your problem?" The booklet lists thirteen significant market surveys including analysis of a chemical market, plant location of packaging material plant, survey of a chemical company as a key to financial position, and uses of new materials.

Marketing and Economic Research is the answer for today's busy executive who needs facts. Information generally comes from published and unpublished data and field interviewing. Data from government statistics, trade associations and other sources are verified by personal contact. Organizing, interpreting and verifying this information follows. Conclusions are tested against known adta.

L—709. Rubber Pic Available—An 18-minute, 35-mm slide film showing industrial rubber products manufactured by Hewitt-Robins Inc. has been completed for presentation to the company's present and potential industrial rubber distributors. The narrated film also touches on the company's history and key personnel.

Hewitt-Robins' industrial rubber products include conveyor and transmission belting, molded rubber goods, and more than 1,000 types of hose. Interested distributors can arrange to see the film by contacting one of the company's field engineers or H. C. Heine at the Hewitt-Robins executive offices in Stamford, Conn.

L—710. New Technical Service—A new technical service is now being offered by the MW Protective Coatings Division of Metalweld, Inc. This service cooperates with engineers and others in studying problems involving corrosion and contamination.

Complete information on this company's services are given in a manual which is available to industries interested in Surface Preparation, Synthetic Resin Coatings, Rubber, Koroseal Sheet and Neoprene Linings, Metallizing, Combination Coatings, Hot Water Tank Linings and Tank Fabrications.

Also included is a Corrosion Questionnaire which will help you to clearly define your particular corrosion problem.

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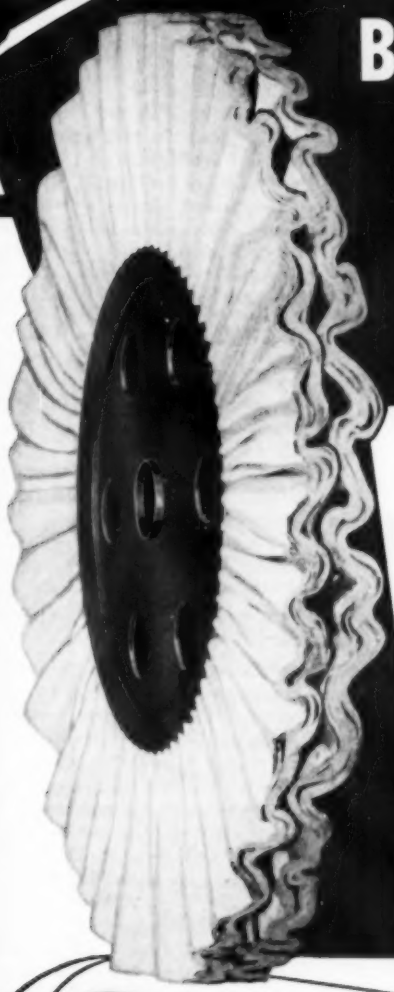

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Trade Literature

L—711. Roll Surface Finishes—Finding the right roll finish for the right job is simplified for mill engineers and machine designers in the textile, paper, plastics, rubber, metal-working, woodworking and other roll-using industries by Rodney Hunt's latest Industrial Roll Engineering Report No. 6. The report, "Roll Surface Finishes", is one of a series published by Rodney Hunt Machine Co., Orange, Mass., intended to assist in the design and selection of rolls for specific plant applications.

A chart is included which will assist selection of proper roll surface finishes for various types of usage. The chart, among other contents, lists average units of time required to attain various degrees of surface finish on steel rolls.

L—712. Precision-Bore Glass Products—Stock precision-bore glass products in quartz, Vycor and glass with internal diameters controlled to within ± 0.0002-inch (for special applications internal diameters may be controlled to within ± 0.00005-inch) are illustrated in Fischer & Porter Company's new four-page catalogue No. 80-20. Applications of precision-bore glass include high-accuracy manometers, barometers, viscosimeters, polarimeter tubes, moulds, Raman tubes, flow restriction nozzles, graduated burettes, and other glass instruments where precise internal dimensions are critical.

Vycor, fused quartz, and various types of glass are described for their physical, chemical, or electrical properties.

L—713. Monel vs Corrosion—A new booklet, "Equipping the Pickle House," is offered by The International Nickel Company, Inc., New York, N. Y., as a practical guide to greater production at lower cost in a wide variety of pickling operations.

The 32-page, two-color booklet describes the use of specially designed Monel equipment in the processing of large and small fabricated parts, hollow ware, and forgings and castings, as well as the common mill forms of steel and tin plate.

More than 70 photographs illustrate practical applications of Monel in sling chains, yokes and special hooks, crates, racks, baskets, drums and other batch handling accessories and in hold-down rolls, lifting arms, pinch rolls, tank guides, and other parts exposed to corrosive conditions in continuous pickling lines.

L—714. Basic Cupola Operation—Basic Refractories, Inc., a leading producer of granular basic refractories, announces the availability of the new booklet, "Operating Practices with the Basic-Lined Cupola."

As a result of the greatly increased interest in special cast irons, the many advantages of basic cupola operation are now being more fully recognized. The booklet discusses in detail the advantages of this relatively new foundry development and explains the mechanics of basic slag systems.

L—715. Bulletin on Wet Blasting Applications—A new bulletin, "A New Source of Profits for Heat Treat Shops," describing the application of the wet blasting process to removing scale from precision work in heat treat shops—work like various tools, plastics molds, and dies for forging, die casting, extruding, cutting, drawing, and forming—has been published by American Wheelabrator & Equipment Corp., Mishawaka, Ind.

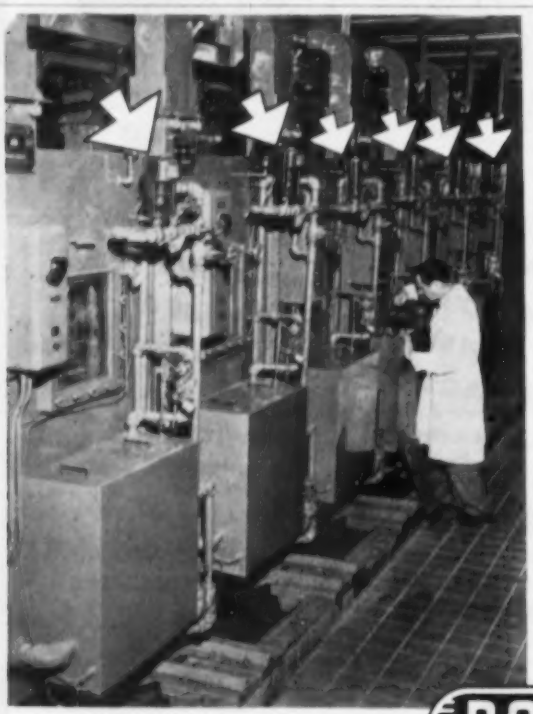
This well-illustrated bulletin has pictures of nine typical parts cleaned in Liquamatte wet blasting machines, together with complete performance data as to the time required for cleaning in each case.

L—716. Bulletin on Audiometer Test Room—A bulletin describing the new Burgess-Manning Acousti-Room for audiometric testing has been announced by the company's Architectural Products Division, Chicago.

The illustrated bulletin gives details of this latest product of the pioneer manufacturers and designers of industrial noise abating equipment.

The room, which weighs 1,200 pounds, is shipped knocked-down and can be assembled in three to four hours. It is completely demountable and can be moved as conditions require.

L—717. Sherardizing "Galvanizing at its Best"—"Facts About Sherarduct," a new booklet recently published by Na-



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Modern research laboratories
METALWASH Spray Washer is controlled by POWERS No. 11 Temperature Regulators

SIMPLICITY of POWERS

No. 11 Self-Operating Regulators, plus their years of reliable control plus availability of SERVICE, in 60 Cities, if required,—are reasons why equipment manufacturers like to use POWERS No. 11 regulators shown above. Bulletin 329 describes their many points of superiority. Write for a copy. (c5)

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Skokie, Ill. • Offices in 60 Cities • See your phone book

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what "LIQUISPRAY" *can mean to you*

- ★ Increased operator efficiency
- ★ More uniform finish and fewer rejects
- ★ Compound costs cut up to 50%
- ★ Tremendous increase in buff life

why *you should use* "LIQUISPRAY"

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- ★ No fire hazard
- ★ No clogging of idle guns
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Here's peak corrosion protection combined with conductivity, weldability and solderability. Here's a finish that holds paint firmly, prevents underfilm corrosion. Here's a line of attractive final finishes to add quality and sales-appeal. Here's Iridite . . . and here's how you can use it:

ON ZINC AND CADMIUM you can get highly corrosion resistant finishes to meet any military or civilian specifications and ranging in appearance from olive drab through sparkling bright and dyed colors.

ON COPPER . . . Iridite brightens copper, keeps it tarnish-free; also lets you drastically cut the cost of copper-chrome plating by reducing the need for buffing.

ON ALUMINUM Iridite gives you a choice of natural aluminum, a golden yellow or dye colored finishes. No special racks. No high temperatures. No long immersion. Process in bulk.

ON MAGNESIUM Iridite provides a highly protective film in deepening shades of brown. No boiling, elaborate cleaning or long immersions.

AND IRIDITE IS EASY TO APPLY. Goes on at room temperature by dip, brush or spray. No electrolysis. No special equipment. No exhausts. No specially trained operators. Single dip for basic coatings. Double dip for dye colors. The protective Iridite coating is not a superimposed film, cannot flake, chip or peel.

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WEST COAST LICENSEE: L. H. Butcher Co.

Trade Literature

tional Electric Products Corporation, is now available for distribution.

Describing the Sherardizing method, as well as the way the company makes Sherarduct conduit, the booklet discusses the advantages of the protection against corrosion offered by steel which has been treated in this way.

The booklet utilizes schematic drawings to show the carefully controlled steps which National Electric takes in the Sherarduct manufacturing process. Pictures of buildings where Sherarduct has been performing for many years are also shown.

L—718. Brochure on Lining and Coating Tank Cars—The MW Protective Coatings Division of Metalweld, Inc. has a new four-page illustrated brochure available entitled "Lining and Coating Tank Cars."

This printing covers the use of sheet linings, liquid synthetic resin coatings, sprayed metal coatings and combination coatings to protect equipment from chemical attack and products from contamination.

L—719. Reprint Offered—Field Report No. 140, a "how-to" discussion on the lubrication of engines and compressors, is available from The Alpha Corporation, Stamford, Conn.

Brief and to-the-point, the field report highlights excerpts from an article entitled "New Methods for Engine and Compressor Maintenance" by Robert S. Ridgeway, Standard Oil Company of California. This article appeared in the January 1954, issue of "Petroleum Refiner."

L—720. Magnetic Conveyors—Homer "space saver" magnetic conveyors and their many industrial applications are described in illustrated bulletin MC-101. In one operation, Homer Magnetic Conveyors both convey and elevate ferrous parts and pieces such as nails, nuts, stampings, washers, tin cans, scrap, etc., up inclines as steep as 90°. Feed point of conveyor can be at floor level or at any desired height on the conveyor. The bulletin also describes how Homer Magnetic Conveyors permit close grouping of production machinery to save plant floor space.

L—721. Contract Metal-Work Facilities—A new 2-color, 4-page brochure has just been issued describing facilities and services of the recently enlarged Precision Manufacturing Co., Inc. metal fabricating plant at Dover, N. J. The folder tells the story of the contract stamping and other metal fabricating facilities at Precision, and of the engineering and tool, die and jig services.

The Dover contract manufacturer of metal products and components operates

Camera Clicks in Cleveland

Opening of the 4th Industrial Exposition —Dr. R. A. Schaefer, president (now past president) is helped by Leon Westbrook, Exposition chairman (right) and Paul Hurd, Commissioner of Public Auditorium (left) while A. J. Lupien, president of the Cleveland branch, Dr. George Swift (former past president), Dr. Samuel Hieman, 1st vice president, and E. L. Combs, general chairman, lend support

L. to r.: R. A. Schaefer, A. Pierson and E. Combs at the "Get Together" party

Above, l. to r.: Henry Bornitzke, Wm. Geissman, L. Dively and Pete Kovatis awaiting opening session. Reverend Frank C. Mesle gave the invocation followed by welcoming addresses from Leon Westbrook, Eugene Combs and Mrs. Frances Hoffman. Manson Glover delivered the keynote address

Above: The executive board on way up steps to stage prior to invocation and keynote speech at opening session

Below, l. to r.: Fielding Ogburn, Dr. E. J. Serfass and Wm. Tucker at "Open House"

First registrants at convention were Mr. and Mrs. Chas. T. McGinley of St. Louis. They are welcomed by W. F. Acks, chairman of registration committee. This was Mr. McGinley's 20th convention

Above, l. to r.: R. Kline, Ezra Blount, F. Gumham and G. Hay at "Get Together"

Above: George Burnley, PLATING advertising manager, in attendance at booth

Below: Guests at Past Presidents' Dinner

Above: Mr. & Mrs. Hoffman at "Open House"

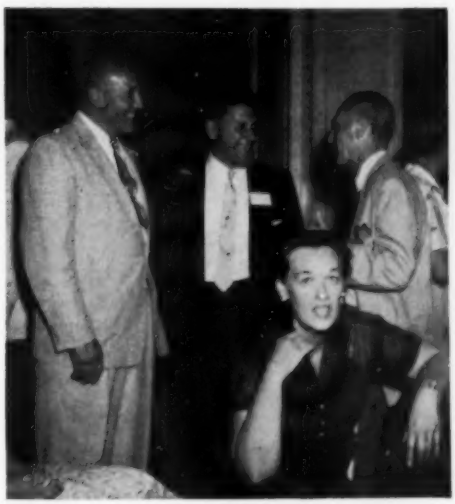
Below: John Martin and party of S. A. Day Co., Buffalo, at "Open House"

AES Research booth drew wide attention

CAMERA CLICKS IN CLEVELAND

Above: H. Struckhoff "drawing" at MFSA "Open House" Monday night

Above, l. to r.: Betty Berdan, Irene Grigas and Betty Luch—the "good right arm" of Clevite Brush Co.



L. to r.: Art Logozzo, Don Isaacs of Sydney, Australia, Mrs. Logozzo, W. D. McDermid

Left, above: Mrs. G. Schore, last year's "Women's Activities" chairlady, and right: Mrs. A. Hoffman of Cleveland, this year's chairlady

L. to r.: A. Amatore and G. Swift outside public auditorium before opening session

Below: A view of busy AES booth—PLATING booth is to the left—just adjoining

Above, l. to r.: Bill Neill and Cleve Nixon on the move

Above: Past Presidents' Dinner

Above: M. Glover delivering keynote address

Above, l. to r.: (background) M. Glover, W. Belke and (foreground) Mr. & Mrs. Head, M. McLeese, at "Open House"

Above, l. to r.: Board of Directors, MFSA, seated: T. Trombour, M. Glover, A. P. Munning. Standing: Dr. Beckwith, A. Braun, R. Ledford, H. Struckhoff, G. Stutz, H. Nice, W. D. MacDermid, J. Duffy

Above, l. to r.: NAMF officers, F. Kaiser, Sec.-Treas.; J. Palek, Pres.; L. Hay, 1st VP; S. Novelli, Asst. Sec.-Treas.; P. Miller, 2nd VP

Below: Old friends and new friends meet at "Get Together"

CAMERA CLICKS IN CLEVELAND

REPORTS from all over

. . . stripped, cleaned and degreased

(This section is especially compiled for the readers of PLATING; here the world in which we work and operate is stripped of its veneer; cleansed of its distortions and carefully degreased of superfluities).

ODM has released three million pounds of nickel for delivery to relieve the shortage. None comes from national stockpile. . . . Lead and zinc stockpiling may be continued in 1956. . . . Copper shortages were relieved somewhat by tonnages released by the United States and British governments. . . . Columbian-tantalum turned out to be the first of the nine long-ranged government programs to be completed in the matter of building a reserve of strategic and critical materials.

Quotations on all metals stand:	
ALUMINUM—(99 per cent pure plus ingot)	23.200
ANTIMONY—Five tons or more but less than carload	31.970
Bulk	28.500
In cases (Port Laredo)	29.000
CADMIUM—Producers' quotation	170.000
Producers' and platers' quotation	170.000
Platers' quotation	170.000
COPPER—Electrolytic, domestic	35.700
Electrolytic, export	36.187
GOLD—(per ounce U. S. price)	$35.000
LEAD—Common, New York	15.000
Common, St. Louis	14.800
MAGNESIUM—(ingot)	28.500
MERCURY—(per 76 lb flask)	$302.920
NICKEL—(F.O.B. Port Colborne U. S. duty included)	64.500
PLATINUM—(refined per oz)	$78.500
SILVER—New York, per/ounce	88.928
London, pence/oz	77.214
TIN—New York	91.380
New York, 99 per cent min	90.380
ZINC—Prime Western (E St. L.)	12.000
Prime Western (delivered)	12.425

PLATING—The 3M fluoro chemical incorporated by *Udylite Corp.* in its Zero Mist is said to be an entirely new, completely stable, surface-active additive for decorative chromium plating baths. When added to the chromium plating bath, these pellets create a yellow foam blanket to keep chromium mist from escaping, cutting chromic acid waste up to 70 per cent. . . . The present US oversupply of hydrochloric acid is expected to last well into 1956 and beyond. Total production by the end of 1955 is expected to hit almost 785,000 tons. . . . To recover strong, white sulfuric acid from spent sulfuric acid, *Consolidated Chemical Industries, Inc.* has five sludge acid regeneration units operating. . . . *Udylite Corp.* advertised its fully automatic barrel plating machine as a heavy-duty, high-production, return-type unit designed for any standard plating process. Any cylinder at any station can be raised or lowered independently by delayed set-down or skip mechanisms. Cylinders can be operated at different speeds. . . . Minute, invisible holes can be made in metals with a new way for machining by etching in an electrically conducting solution, according to *Bell Telephone Labs.* Different shapes can be made by moving the tip with respect to the work. Plating with metals at a particular tiny point also was achieved. . . Use of the Solu-Bridge automatic rinse-tank controller is claimed by *Industrial Instruments, Inc.* to greatly reduce water consumption and increase electroplating quality. It continuously measures the degree of electrolytic conductivity of rinsing waters to maintain automatic control of the amount of fresh water admitted.

METAL INDUSTRIES—*Magnasync Mfg. Co.* offers complete automation for a small manufacturing plant with 10 average milling machines for less than $100,000, including equipment needed to make magnetic tape recorders. . . . *Mercury Engineering Corp.* entered the automation field with its Copymill milling machine for automatically copying a tracer piece from instructions on magnetic tape or other media. It is claimed to turn out finished work twice as fast as existing equipment and to cut machining costs by 50–75 per cent.

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AES Research Reports

Publications originally appearing in THE MONTHLY REVIEW and PLATING, reprint of which may be obtained from the office of the Executive Secretary, 445 Broad Street, Newark 2, N. J., at the prices listed.

Reprints Serial No.	*Price $*	*Title*	*Authors*
12	3.50	Cleaning and Preparation of Metals for Electroplating, IV, V, VI & VII	H. B. Linford E. B. Saubestre
7	1.35	Methods for Testing Thickness of Electrodeposits, II & III	H. J. Read & F. R. Lorenz
6	.85	Porosity of Electrodeposited Metals, Parts X, XI, XII & XIII	N. Thon, Denis Keleman & Ling Yang
2	.90	Determination of Impurities in Electroplating Solutions, Parts XX, XXI, XXII & XXIII	E. J. Serfass & Co-workers
14	1.10	Taper Sectioning of Basis Metal Surfaces and Electrodeposits, Parts I & II	A. E. R. Westman F. A. Mohrnheim

SPECIFICATIONS and TESTS for ELECTRODEPOSITED METALLIC COATINGS*

STANDARDS RELATING TO ELECTRODEPOSITED METALLIC COATINGS

Specifications for:

- A 164-53. Electrodeposited Coatings of Zinc on Steel
- A 165-53. Electrodeposited Coatings of Cadmium on Steel
- A 166-53 T. Electrodeposited Coatings of Nickel and Chromium on Steel (Tentative)
- B 141-45. Electrodeposited Coatings of Nickel and Chromium on Copper and Copper-Base Alloys
- B 142-53. Electrodeposited Coatings of Nickel and Chromium on Zinc and Zinc-Base Alloys
- B 200-53 T. Electrodeposited Coatings of Lead on Steel (Tentative)
- B 201-49 T. Chromate Finishes on Electrodeposited Zinc, Hot-Dipped Galvanized, and Zinc Die-Cast Surfaces (Tentative)

Methods of:

- A 219-51 T. Local Thickness of Electrodeposited Coatings, Test for (Tentative)
- B 117-49 T. Salt Spray (Fog) Testing (Tentative)

Recommended Practices for:

- B 177-49. Chromium Plating on Steel for Engineering Use
- B 183-49. Low-Carbon Steel for Electroplating, Preparation of
- B 242-53. High-Carbon Steel for Electroplating, Preparation of
- B 252-53. Zinc-Base Die Castings for Electroplating, Preparation of
- B 253-53. Aluminum Alloys, Preparation of and Electroplating on
- B 254-53. Stainless Steel, Preparation of and Electroplating on
- B 281-53 T. Copper and Copper-Base Alloys for Electroplating, Preparation of (Tentative)

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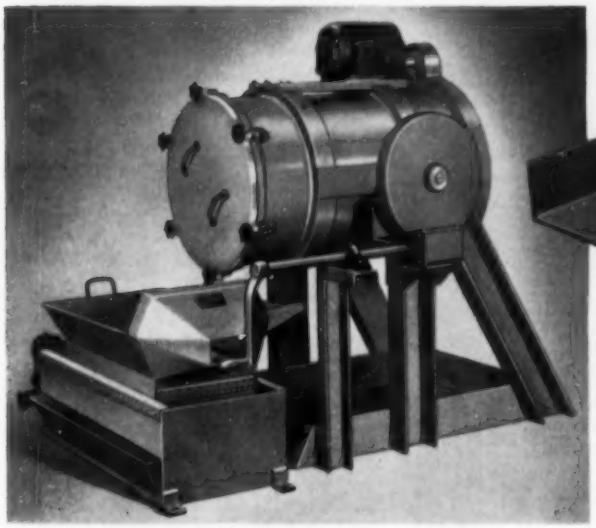
★ Service Proved for 20 years

★ Barrel revolves in two large diameter, radial thrust ball bearings assuring smooth operation regardless of barrel position

★ Compact, direct gear drive — eliminates belts and pulleys.



BELKE Model C Burnishing Barrel With Motor-driven Separator

Saves Time — Saves Labor — Saves Space

Large capacity barrel has worm screw tilting mechanism that positions barrel for loading burnishing and unloading.

Finished work pours from Burnishing Barrel right into Separator without handling. Motor drive shakes screen to separate media from work.

Tilting hopper and removable drawer speed removal of media and finished work.

Easily interchangeable screens framed in wood protect finish of work. Mesh sizes and shapes to specifications.

Motor driven separators available for all Belke Burnishing Barrels.

Ask your BELKE Service Engineer or write.

FEATURES

★ **Smooth Operation.** Patented bearing construction assures smooth running with cylinder in any position — No vibration even with capacity load.

★ **Direct Gear Drive.** Gears enclosed. No belts.

★ **Motor Mounted on Top.** Stays dry. Out of the way. Easily accessible.

★ **Constant or variable** speed drive.

★ **Barrel Balanced** for easy tilting.

★ **Self-Sealing Cover** of light weight aluminum.

★ **Spring pressure Ratchet Lock** released by foot lever —holds barrel at any angle.

★ **Rugged Frame** of welded steel affords absolute rigidity. Will not warp or twist on uneven floors.

★ **Base is Flanged** to receive tote tray.

★ **Hard Maple Lining**—easily removable. Rubber lining or steel ribs welded to inside surfaces available.

★ **Three Models** — The right size for every shop.

Ask your BELKE Service Engineer or write.

Belke **Manufacturing Company**
947 N. Cicero Ave., Chicago 51

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Regular printed reports on developments of all research projects.

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Trade Literature

several banks of presses ranging in pressing capacities up to 250 tons and deep drawing bed sizes up to 72 inch x 42 inch. In addition it has a complete shearing and brake forming department, tumbling and spraying equipment, extensive steel storage and handling facilities, its own fleet of delivery trucks and numerous welding and riveting units.

L—722. American Agile's Brochure Gives Line of Products, Components, Production Equipment—A new, four-page brochure, illustrating and describing its complete line of products, semifinished components, and production equipment, plus its many services, has just been issued by the American Agile Corporation, Bedford, Ohio.

The free literature is divided into four convenient classifications. The first details the company's line of thermoplastic semifinished components designed for fabrication in a customer's own plant.

The second section illustrates and describes fabrication equipment now available from the company. This includes plastic welding kits, welding guns, and spraying units for spraying polyethylene.

A special section is devoted to a discussion of the company's irradiated polyethylene designed for use at elevated temperatures up to 300° F.

L—723. Glassware—A four-page, two-color bulletin dexcribing its new Diamond D Blue Line of Laboratory glassware has been issued by Doerr Glass Company, Vineland, N. J.

The bulletin covers in some detail the features of this new laboratory glassware line, especially the Doerr double-test for accuracy, the electrically-controlled annealing which removes internal strain, the fusing of blue pigment in the graduations, and the care with which the line is calibrated.

L—724. Properties of $MoCl_5$—A new four-page bulletin, "Properties of Molybdenum Pentachloride", is now available on request from Climax Molybdenum Company, New York.

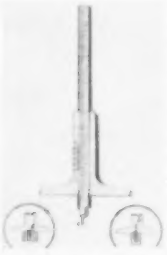
Designated Bulletin Cdb-3, the publication gives the more important physical and chemical properties of chemically pure molybdenum pentachloride. It also describes the preparation of the compound.

Covered in the section on chemical properties are the reaction of molybdenum pentachloride with oxy and hydroxy compounds, nitrogen compounds, and phenolics; its function in organic addition reactions; action as a catalyst in chlorinations; reaction with carbon monoxide to form molybdenum carbonyl; and its reduction to the trichloride and to the metal.

Equipment & Supplies

Please use Reader Service Card for all items in this section

E—725. Depth Gage—A quick-acting new Mauser Vernier Depth Gage for diemakers, toolmakers and mechanics is announced by the George Scherr Company.



Gem of a Gage

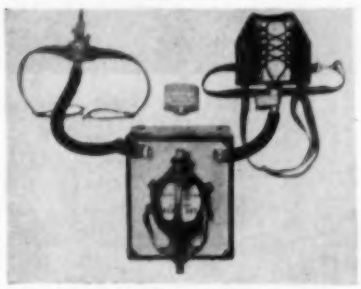
Equipped with a 1/1000 inch vernier, these depth gages fill a long felt want for a fast and direct reading depth gage by scale and vernier. Swift in action and responsive to the most delicate touch they are ideal for fine work. Instant adjustment to zero and point adjustment by a small set screw enables them to be kept at perfect accuracy.

The new Mauser Depth Gage will solve depth measuring problems of small holes. A hardened pin 1/32 inch in diameter, held securely by a small set screw is used as feeler point and enables the operator to measure depth of holes as small as 1/32 inch in diameter. Small deep holes may be checked by replacing standard pin with a hardened long straight pin, which can be accomplished within seconds.

An open slide permits view of entire scale resulting in faster reading and avoiding of errors.

E—726. Mask Kit—A gas mask kit designed to meet any plant hazards for millwrights and maintenance men has just been announced by Acme Protection Equipment Company, South Haven, Mich.

This Acme maintenance mask provides a full-vision face piece for dust and smoke



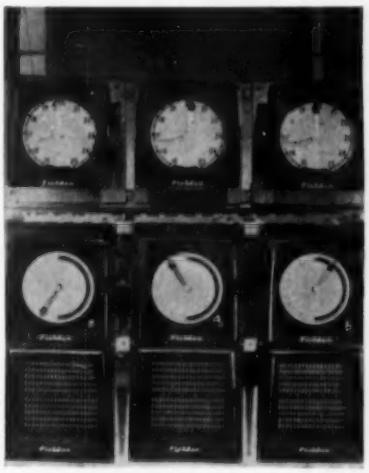
Mask Your Men

protection; a canister mask to protect against all gas hazards and visible smokes from fires; and an air-supplied mask (plant compressed air) for use in any harmful or objectionable atmosphere.

The maintenance man is prepared to meet any hazardous atmospheric condition in the plant with this multi-purpose mask equipment.

E727—. Watchdog Instrument—Three identical 76-point scanning instruments undergo final tests at Philadelphia plant of manufacturer, Fielden Instrument Division of Robertshaw-Fulton Controls Company.

dog which can oversee six, 12, 24, 48 or more different steps at once in a manufacturing process. Units at top indicate temperature of each step in process as it comes under control. Units in middle tell which step is being controlled. If the temperature deviates from a prescribed setting, the instrument will stop automatically, showing an attendant both the location and extent of the trouble.

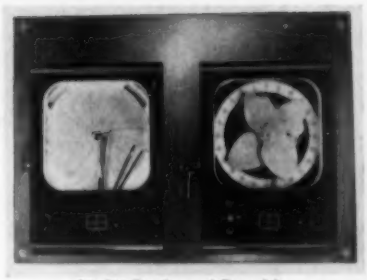


Round the Clock Watchmen

To restart scanner, attendant presses reset button. Scanner will stop on overtemperature point again unless the condition is corrected, or a by-pass connection made through the use of sliding connectors shown in the bottom case.

E—728. Surface Resistance Indicator—This portable instrument is used to test for the effectiveness of any cleaning process used to prepare metal for resistance welding. It provides an accurate means for measuring the resistance between two pieces of metal in a matter of seconds. By knowing this resistance before welding, such common difficulties as electrode pick-up, inconsistency of welds, and metal expulsion can be greatly reduced. Designed for use with any resistance welding application, it is particularly valuable with aluminum welding.

The equipment consists of two parts—a microhmmeter and a sample holder. The microhmmeter has two ranges of 0 to 200 microhms and 0 to 2000 microhms.



Light, Bright and Portable

E—729. Lightweight Four and Six Channel Portable Oscillographs—Lightweight, portable oscillographs are the new developments in the field of recording systems announced by the Brush Electronics Company, Cleveland, Ohio.

The new portables are designed for either four or six channel recording. The four-channel oscillograph weighs 36 pounds and the six-channel recorder is 48 pounds. Despite their light weight and compactness, either model provides full range instrumentation.

E—730. Barrel Chrome Plater—A barrel-type chrome plating machine which does away with racks or fixtures in the plating of small parts is now available in this country from the Dawson Corp., No. Pelham, N. Y.

Believed to be the first successful barrel chrome plater marketed in America, the Riedel makes it possible to plate small screws and nuts as well as precision instrument, optical, camera and similar parts by simply dumping them into the basket and processing them for about ten minutes. A uniform bright or dull chrome plate may be obtained without the need for hanging small parts on racks or jigs.

These barrel platers are available in three general types. The Economy has a capacity of approximately 1¼ gallons for short or intermittent plating of very small pieces. The Standard has an approximate capacity of 10½ gallons of plating solution.

The Standard is extremely versatile as to the size and shape of parts plated, and is especially designed for long production runs. It is equipped with a vapor exhaust and either a water jacket for cooling or a reserve tank through which the solution is circulated.

Both the Economy and Standard models are supplied with two baskets so that one may be loaded while the other is working, thus assuring virtually uninterrupted operation.

Compact Chromium Plater

SINGLE-KNOB CONTROL provides easy finger-tip setting adjustments.

GENERAL ELECTRIC ANNOUNCES

NEW Germanium Plater That Will Save You Money in Your Plating Operation

Now General Electric brings over four years of germanium experience into the plating field with a new 1000-amp plater that will make possible big savings in your plating operation. Designer and builder of more germanium units than all its competitors combined, G.E. offers you "XB"—experience bonus—along with economy of operation.

YOU SAVE MONEY in installation, operating, and maintenance costs with these new G-E germanium rectifier plating power supplies.

Installation costs are lower, because these compact, lightweight rectifier units need no special foundations.

Operating costs are greatly reduced by germanium's high over-all conversion efficiency*—90 per cent even at 12 volts d-c.

Extremely low maintenance costs in germanium platers result from a minimum of moving parts, and an absence of aging in the germanium element.

NEW G-E GERMANIUM PLATING POWER SUPPLIES feature down-draft air cooling, single-knob finger-tip control, and complete control flexibility. In addition, these 1000-amp, 12-volt units have smooth, stepless control, and hermetically sealed rectifier cells for long life in corrosive plating room environment.

G.E.'s down-draft air cooling draws air in horizontally through the front panel minimizing dust and dirt intake.

Single-knob finger-tip control means not only simplified adjustment, but elimination of multi-knob fumbling and possible transformer unbalance, as well.

Complete control flexibility permits the addition of automatic control in the future without necessitating complete replacement of the manual control.

To date, over 5990 kilowatts of G-E germanium rectifier power supplies are in operation—the equivalent of 1,000,000 amperes at six volts, the normal plating voltage—with another 5080 kilowatts on order. G.E. offers you real germanium know-how based on experience.

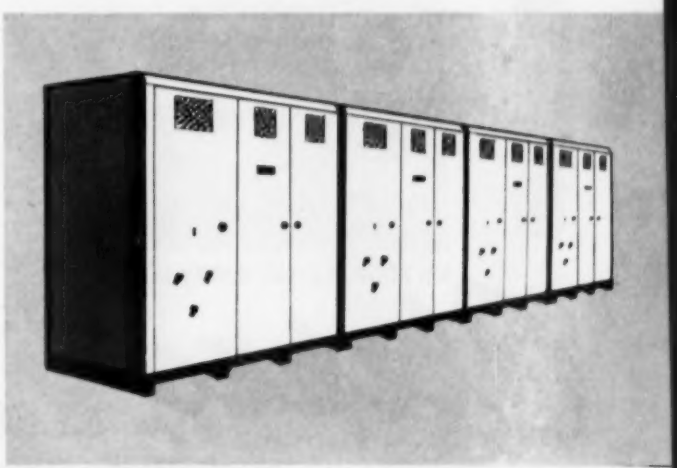
ADDITIONAL INFORMATION on G-E germanium plating power supplies is available from any authorized G-E plating agent, or by writing Section 463-12, General Electric Co., Schenectady 5, N. Y.

*Measured in accordance with recognized ASA, AIEE, and NEMA standards.

Progress Is Our Most Important Product

GENERAL ELECTRIC

EASE OF INSTALLATION, and the fact that only one side of the rectifier need be clear, helps eliminate layout problems.



"BIG BROTHER" of the new plating power supply, this germanium installation furnishes d-c power for anodizing operations.

Equipment & Supplies

E—731. Sump Filter Pumps—Sethco Mfg. Co., Brooklyn, N. Y., announce an addition to their line of pumps for filtering expensive solutions such as silver, gold, rhodium and palladium electroplating solutions where loss of any liquid cannot be tolerated.

Sumps Up!

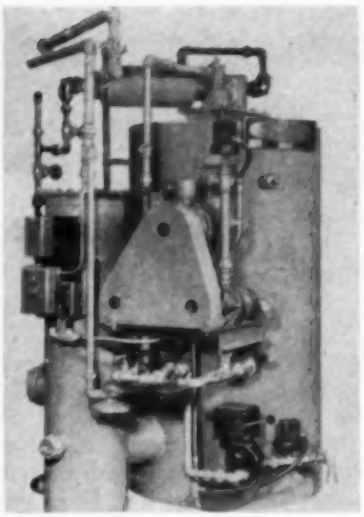
Sethco Sump Filter Pumps consist of a sump pump, a tank and a filter assembly. The sump pump is mounted in the tank and completely insulated from it. The filter assembly is connected to the pump through an opening in the side of the tank. The sump pump is self-priming and inasmuch as it is immersed in the liquid being pumped, there can be no loss of liquid.

The illustration of Model LSI-10ST (rated at 100 gallons per hour) shows a stainless steel sump pump, a stainless steel tank and a high temperature lucite filter assembly. The tank will hold 4 gallons of liquid. This tank can serve as a sump catching the overflow from a larger tank, or it can be used as the actual plating tank. The size of the tank can be varied to meet any application. The equipment is versatile in that the customer can place the sump pump into any one of his own tanks with connection being made to the Sethco filter assembly directly through the tank or over the tank.

E—732. New Holcroft Generator—The design of a radically different exo-endothermic gas generator to provide the necessary gas atmosphere for heat-treat furnaces has been announced by Holcroft and Company, Detroit 10, Mich.

Called the Exo-Endo, the generator is a compact unit requiring only 20 square feet of floor space and can be used effectively with all types of furnaces. According to company engineers, it can produce gas atmospheres between the limits of perfect combustion and modified 302. At the latter setting, the gas generated has two main differences from a standard AGA Type 302 gas. The first has much lower dewpoints—as low as minus 50° F with no detectable amounts of methane. Secondly, the gas produced has approximately 50 per cent lower hydrogen content. This means that for a given carburizing potential, less hydrocarbon addition is required. The lower hydrogen percentage is an added safety feature.

With a slight adjustment the generator can produce a nonexplosive atmosphere for heat treating below the explosive limits



Generating with Gas

required for atmosphere tempering, annealing, and stress relief of ferrous alloys as well as hardening, annealing and tempering of nonferrous alloys.

E—733. Chromium Plating Barrel—A recently developed chromium plating Barrel, capable of bulk chromium plating small parts, is now being marketed by the Marlane Development Co., Inc., New York.

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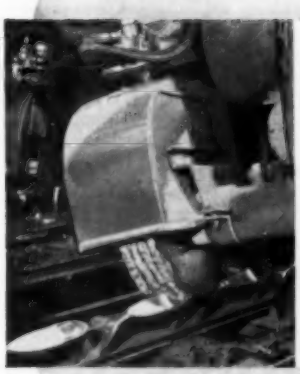

How much of the compound in your buffing room is wasted... in the nubbin pile, or in "over-heading" buffs? There's a way to "meter" the compound you use—the Liquimatic way. An electrically timed system in the Liquimatic Process feeds the exact amount of liquid compound for the exact cut you need. While compound is being saved, buffs are being saved too ... continual lubrication extends buff life up to 400%.

These two cost-saving advantages alone soon pay for a complete Liquimatic Application System. But there are still other ways Liquimatic will help you cut costs. No hand application, and no changing of bars will effect substantial downtime savings for you... and Liquimatic's ease of cleaning means even further economies. Now—when production must be upped, and costs lowered — profit from Liquimatic—over and over again.

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These additional Liquimatic features mean real savings in terms of time, money, safety—

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- completely automatic
- fast cutting
- easy cleaning
- non-settling
- high flash point
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1437

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H-VW-M

INDUSTRY'S WORKSHOP FOR THE FINEST IN PLATING AND POLISHING PROCESSES • EQUIPMENT • SUPPLIES

Equipment & Supplies

E—734. Portable Ovens—A new line of laboratory and small production ovens is announced by The W. W. Sly Manufacturing Company. These ovens are portable, specially designed for temperature uniformity, and built strong for long, hard usage. Self-contained and ruggedly constructed, they offer the versatility so important in cabinet ovens.

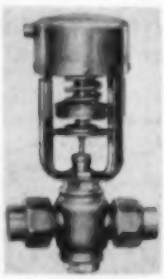
Even Heat

Among their features are electrical interlock for turn-off of heat in case of blower motor failure, manual interlock for purge period operation of blower without heat, uniform work chamber temperatures, high volume adjustable air flow, and adjustable exhaust and intake.

These ovens are supplied in the horizontal flow type of maximum temperatures of 650° F to 850° F with cfm of 400 to 1000. Vertical flow ovens range from 650° F to 850° F with cfm of 600 to 1200.

In addition, Sly offers industrial portable electric ovens which can be used singly or in batteries; also high temperature ovens, thermostatically controlled, for high temperature processing such as stress relief of springs and plated parts; and a complete line of large industrial convectioneered ovens up to 700° F.

E—735. All-Metal Motor Valve—A bellows-equipped all-metal motor valve with outstanding modulating characteristics has been developed by the Fulton Syphon Division, of Robertshaw-Fulton Controls Company for use with hydraulic and pneumatic control systems.



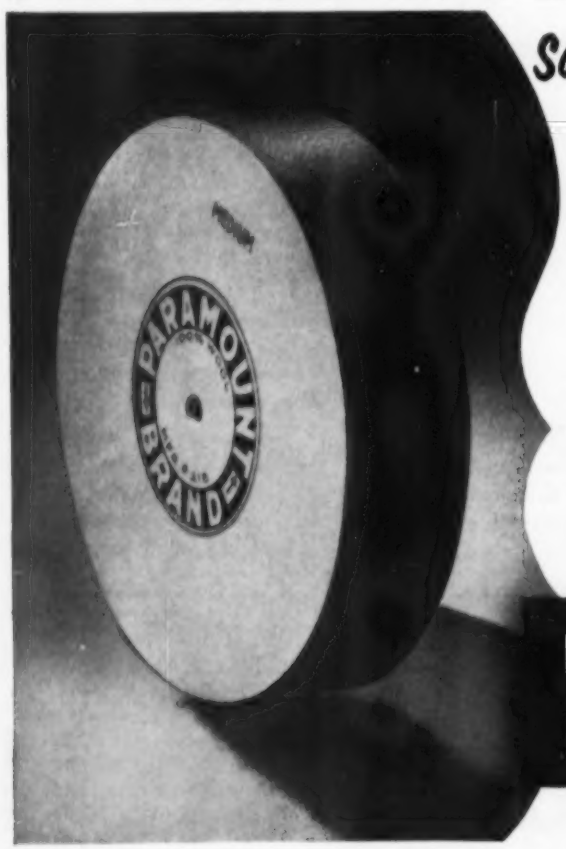
Valve Value

The valve, equipped with a powerful cadmium-plated steel spring and two-ply seamless metal bellows, is used to control the flow of steam, gas, oil, water and other fluids. It is employed as a final control element in pneumatic and hydraulic systems to maintain pressure, temperature or level in industrial vats, tanks, and processes.

Dry Foot!

E—736. Sylflex Tanned Leather Work Shoes—Water repellent work shoes that resist absorption of chemicals and filth while lasting longer is the promise of a new line of Sylflex tanned shoes and boots introduced by Red Wing Shoe Co. Sylflex is the newly developed Dow Corning silicone treatment which makes leather permanently water repellent and lengthens the life of shoes.

The new work shoes with Sylflex are being offered initially in two styles; a six-inch shoe and an eight-inch outdoorsman's boot. They are made with a high-grade glove leather and will be sold by Red Wing retailers throughout the country.



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Whether you work with metals as soft as aluminum or as hard as steel, it's 20 to 1 your polishing applications call for abrasive grains in the 120-240 range. It's here that eye-appealing finishes are born — and it's the very range where Paramount Felt Wheels set up with the proper abrasive can do the most for you — both quality- and cost-wise.

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10 They can depend on MICCROSOL!

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Equipment & Supplies

E—737. Spray Metallizing—This new process recently introduced by Jenn Chemical & Supply Co. produces a hard, durable high lustre finish requiring no treatment beyond the protective coating. The first really practical substitute for expensive plating methods, this type of process reaches down into the deepest interstices or undercuts, without polishing. The metal deposit literally envelopes the items from all angles; not just the surfaces directly in line with the atomized spray.

The resulting top coat may be left clear with a rich silver-chrome appearance, or may be dyed gold, brass, copper, or one of many other colors suitable to the final product.

Silver Spray

E—738. Recoilless Pneumatic Refractory Rammer—A new lightweight and recoilless pneumatic refractory rammer specifically designed to reduce the application time of applying refractories around open hearth tapping spouts and furnace doors has been announced by the Vibron Division of the Burgess-Sterbentz Corporation, Cleveland 11, Ohio.

New-Matic

The rammer, Model G-162S, is light, easy to handle, and delivers fast, powerful recoilless strokes. Workers' efficiency is increased and fatigue decreased through the elimination of recoil shock and heavy vibration. The rammer action also minimizes the probability of physical injury to workers by eliminating the severe vibratory kickback and refractory throwback.

Made of an aluminum alloy body and fitted with a hard chrome piston, the rammer comes equipped with a six-foot ramming head, flexible rubber handgrip, a handtrigger and a quick-connect air line coupling. Seal and bearing replacement is eliminated so that its maintenance is simplified and inexpensive. It operates efficiently at a low air consumption from a light, easy to manage, ¼-inch air supply line.

E—739. Improved Coating Thickness Tester—The Lea Manufacturing Co., Waterbury, Conn., specialists in finishing methods and materials, has placed on the market an improved design of the Lea Lectromag, a precision instrument for measuring thickness of nonmetallic coatings such as zinc, copper, cadmium, lacquer, on carbon steel or iron.

Lea Tester

Improvements in design and utility of the Lectromag include: Calibration with National Bureau of Standards Thickness Samples; plug attachment at side rather than top, providing better, 360° visibility of the indicator, sturdier construction and easier manipulation of the tube assembly; knurled rather than smooth top on the glass tube assembly, providing a better grip for manipulating the glass tube, and a new compact instrument case with calibration chart for easy and simple calculation of thickness.

The Lea Lectromag has a thickness testing range from 0.0002 to 0.008 inch with the following accuracies: ±15 per cent on thicknesses under 0.001 inch and ±10 per cent on thicknesses over 0.001 inch.

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From surface cleaning to finished sealing, these Promat-Quality products can help you "cash in" on 18 years of research dedicated to one purpose . . . lasting, protective beauty for metal:
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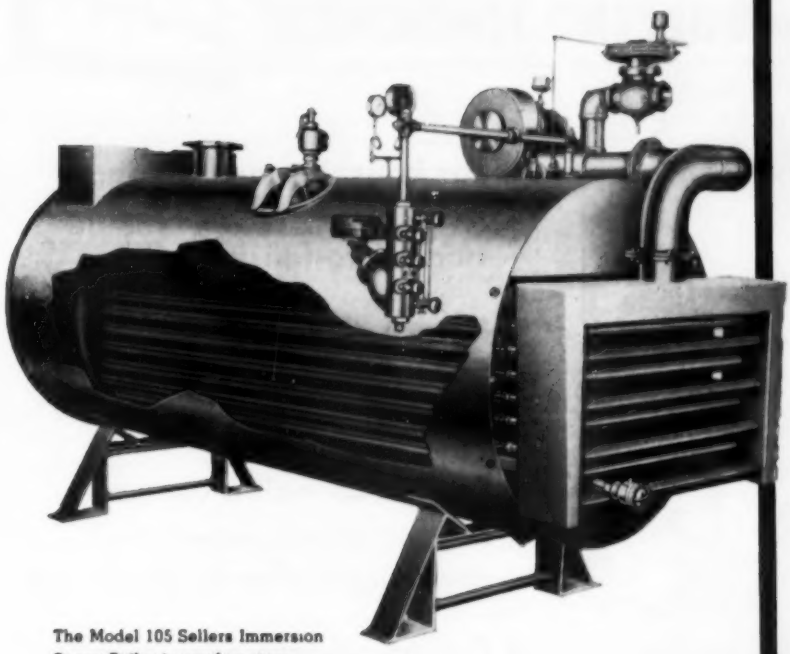

The Model 105 Sellers Immersion Steam Boiler is another steam boiler designed and built with totally submerged and horizontally located firing tubes.

This system of firing permits all gas to be burned inside the submerged tubes — and therefore *inside the water.*

Every tube is an individual combustion chamber with its own burner — *completely surrounded by water.* This is the most efficient method ever devised.

And this system permits "spreading out the fire" — to put every square foot of heating surface to work, increasing life, internal circulation, and operating efficiency.

The Sellers Model 105 Immersion Steam Boiler is only one of a complete line — all are companion boilers to the famous Sellers Model 46. Investigate this line — there is one to fit your requirements.

BEFORE YOU BUY ANY STEAM BOILER, CONSIDER THESE FACTS

- ***MINIMUM SCALE PROBLEM***
  Intermittent firing of the boiler brings about alternate expansion and contraction of the firing tubes which loosens scale which might form on the tubes. This scale drops to the bottom of the shell out of the firing zone and cannot bake on to the firing tubes. Clean out openings are provided.
- ***CONTINUED HIGH EFFICIENCY***
  As long as firing tubes are kept clean, original high efficiency is economically maintained.
- ***NO WATERLINE CORROSION***
  With all firing tubes totally submerged, there is no corrosion at the waterline—where tubes normally fail. In Sellers immersion type steam boilers, there can be no waterline corrosion.
- ***MORE EFFECTIVE INSULATION***
  More effective insulation is possible because the insulation is against heat loss from low temperature steam and water instead of a high temperature combustion chamber.
- ***FASTER STEAMING AND DRYER STEAM***
  Rapid steaming and dry steam takes place because of the large surface area of the water. All surface water is heated first since the firing tubes are located close to the water line.

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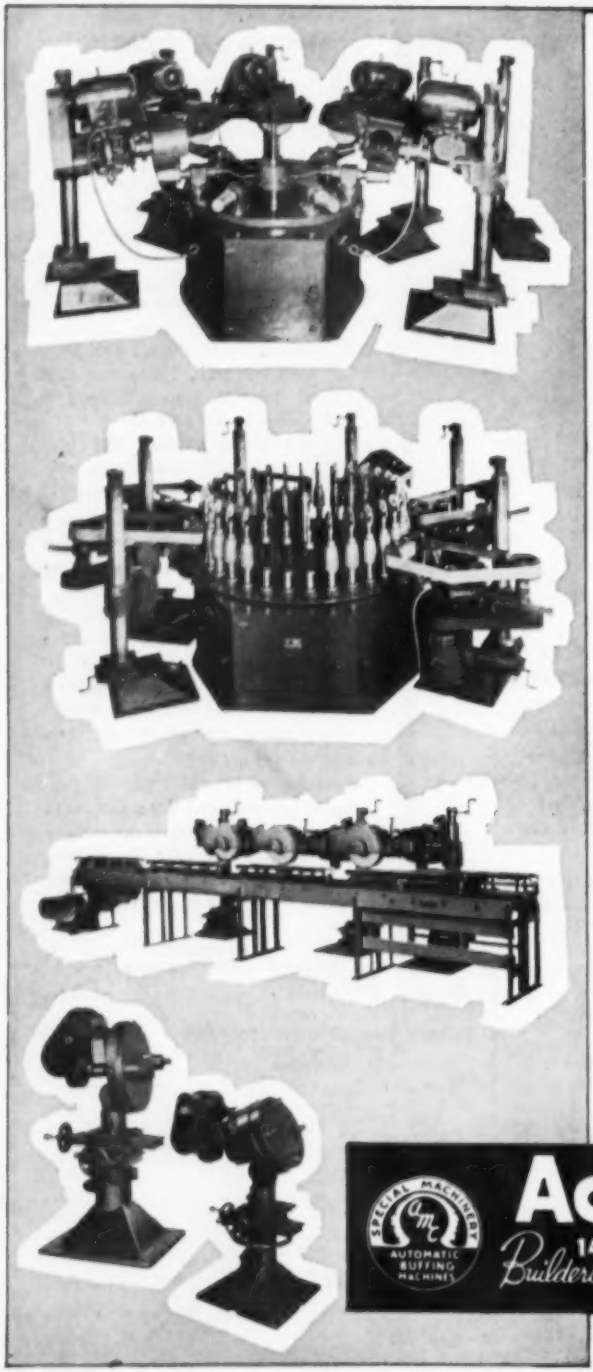

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He must be able to prepare, analyze, and maintain solutions, determine current densities, size and composition of electrodes, immersion times, etc.

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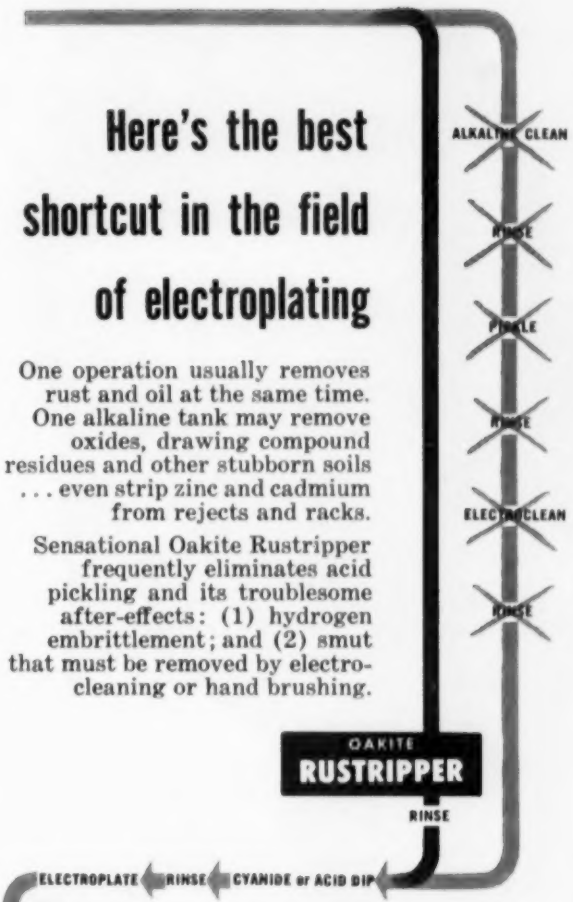
Sensational Oakite Rustripper frequently eliminates acid pickling and its troublesome after-effects: (1) hydrogen embrittlement; and (2) smut that must be removed by electrocleaning or hand brushing.



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Now! Control both carbonate and cyanide with one compound . . . WES-X 150

New and exclusive 2-in-1 carbonate remover also replenishes cyanide; is the easy, low-cost way to keep any metal cyanide plating bath at right concentration for high-speed plating.

Westinghouse has developed a new and far better way to control cyanide plating. It is WES-X® 150—an efficient and economical compound which removes carbonates, helps eliminate certain contaminants; and maintains or increases uncomplexed or free cyanide at the same time.

Here are the big advantages of WES-X 150:

- High reaction efficiency—1.1 oz of WES-X 150 removes 1 oz of carbonates.
- Economical—1 oz of WES-X 150 yields 1.0 oz free cyanide.
- Precipitated particle size greater than with other methods—less work to handle and filter precipitate.
- Will not upset hydroxide control.
- Supplied in convenient metal drums.

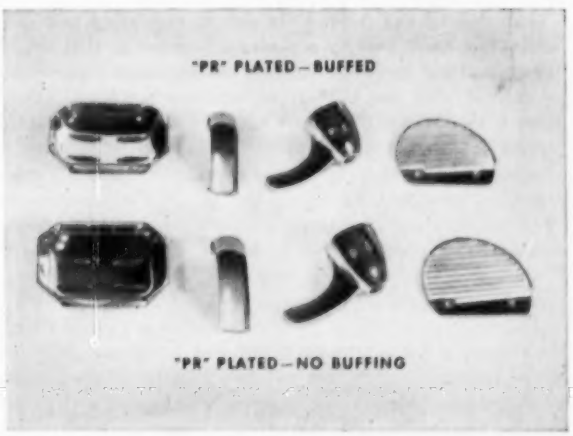
It is not necessary to batch treat the whole solution when WES-X 150 is used. And once WES-X 150 gets carbonate concentration within required limits for high-speed plating, it is an easy and low-cost means to control this concentration with WES-X 150 . . . the simplest and cheapest way to get the most out of your plating time!

Let a Westinghouse sales engineer help you put this new compound to work in your operation. All it takes is a free survey of your plating process and a specific recommendation on its application. Call your nearest Westinghouse sales office or write: Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-10442

YOU CAN BE **SURE** . . . IF IT'S

Westinghouse

Westinghouse offers metal finishers a unique combination of advanced WES-X Compounds and application service. This Pilot Plant electroplating lab gives new processes a head start—makes them commercially sound. WES-X 150 was proved here. WES-X 100C, 102, 303A and 304 are other compounds.



This is an example of "PR"—Periodic Reverse—Plating. Bottom row shows superior leveling characteristics of "PR" . . . appearance is equal to buffed castings—with *no* prefinishing. "PR" Plating is one of the many *new* ideas and compounds to come from Westinghouse development.

METHODS OF CONDUCTING CLASSES FOR ELECTROPLATERS*

J. M. Andrus addresses class in electroplating at the Illinois Institute of Technology

EZRA A. BLOUNT†

ABSTRACT

The electroplating industry's increase in stature and importance has been accompanied by a rise in the level of technical and practical "know how" of the people in that industry. To maintain, increase and extend this level of technical knowledge, a few courses in electroplating have been established to provide instruction in the principles of chemistry and the basic principles and practice of electroplating. This paper will report on some electroplating classes currently being conducted in private educational institutions and in public school systems, comparing specific courses of study, course outlines, methods of teaching and other details.

INTRODUCTION

The American Electroplaters' Society was founded as an educational society for the "improvement and dissemination of the knowledge of the arts and sciences of electroplating. . . ." It is my impression that, actually, the Society was founded by a group of men in the plating business as a means of helping one another with mutual problems.

The Society has fulfilled its aim in improving and disseminating knowledge by organizing branches so that members can attend meetings regularly and exchange experiences or consult with one another on common problems. Further, branches invite speakers to address the members on special topics so that knowledge in various fields can be extended. It is important to recognize the tremendous contribution made to the advancement of the educational aim of the AES by plating supply and equipment manufacturers through their program of furnishing speakers for AES Branch meetings, and their distribution of technical literature bearing on plating processes.

The Society, to aid in the dissemination of information, established a journal to be distributed to all members in which technical articles on various aspects of plating were published. In a like manner, other technical and trade magazines in the field have contributed to the educational effort through the publication of technical and practical articles on all various allied subjects.

Two members of the Society, Dr. William Blum and George B. Hogaboom, wrote a book, "Principles of Electroplating and Electroforming," which has become the standard textbook for electroplaters. With the exception of the preparation of the book just mentioned, most of the effort of the Society has been along the line of bringing to the members new developments in the field of plating, with little effort being devoted to the education of men without a knowledge of plating, or educating men in the industry so that they could be of more service to the industry and command better positions.

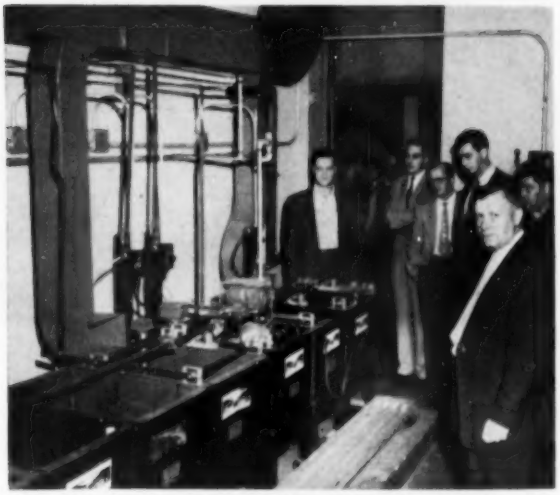
As a result of the growing awareness of the need for and desirability of training men in the principles and practice of electroplating, there is at the present time more of an effort being placed on such training than ever before. Dedicated men, most of them leaders in their Branches of the AES, have organized and are conducting classes in electroplating. These classes have been established in public and private schools and colleges.

It is the purpose of this paper to report on some of these classes, recognize the tremendous effort that is being put forth, and by this recognition to spur the efforts of others in a similar vein to the end that education in plating shall be made available in more centers of this great industry.

At the present time, under the direction of Vice-President Heiman, data concerning electroplating classes are being col-

*Presented at the 42nd Annual AES Convention, Cleveland, Ohio. The discussion following the presentation is not included here, but will be found in the "Annual Proceedings of the AES, 1955."

†Editor, Products Finishing Magazine, Cincinnati, Ohio.



Instructor Andrus and some of his students assembled in the newly-installed electroplating laboratory at Illinois Tech

lected and tabulated by Louis Serota, Arthur G. Pierdon and Fielding Ogburn, so that it may be included in the appropriate section of the AES Branch Officers' Manual. Another purpose of this paper is to emphasize the importance of that worthwhile project and assist in its successful achievement.

CLASS AT ILLINOIS INSTITUTE OF TECHNOLOGY, CHICAGO

A one-year course in electroplating is being conducted at Illinois Tech as an evening course in the Department of Metallurgical Engineering. This course was organized in 1950 by Clyde Kelly and J. M. Andrus, who became the class instructor, to train people for the job plating industry in the area. The Chicago Electro-Platers' Institute maintained an active interest in the class; and in 1953, a CEPI committee headed by Robert L. Giesel raised well over $9,000 from plating supply and equipment companies, the CEPI, and the Chicago Branch of the AES, to finance the purchase and installation of plating equipment in an Illinois Tech Laboratory. Figure 1 shows instructor Andrus in the lecture room, and Figs. 2 and 3 are views taken in the room devoted to actual work with plating equipment.

The class is held one night per week, two 1-hour periods, for two semesters. Subjects considered include:

1. Fundamentals of chemistry applied to plating.
2. Fundamentals of electricity—power for plating.
3. Plating baths and their characteristics:
   - Nickel
   - Acid copper
   - Cyanide copper
   - Chromium
   - Cadmium
   - Zinc (including chromate dips)
   - Anodizing
   - Electropolishing

The first semester consists of lectures and demonstrations, including work in a regular chemical laboratory. The second semester consists of lecture and student participation in plating experiments. Solution control is taught by the use of comparative tests and testing sets. There is some solution analysis and simple titration.

Through the use of the newly installed plating equipment, the students gain actual experience in racking, plate distribution, handling of rheostats, degreaser operation, plating barrel operation, as well as a knowledge of some of the problems of installation of plating equipment.

The equipment installed in the new plating laboratory (Figs. 2 and 3) includes the following: vapor degreaser, rectifier (200 amperes at 9 volts), filter, line of 60-gallon cleaning and plating tanks, portable plastic plating barrel, polishing stand, Hull cell plating solution test unit.

J. M. Andrus, the class instructor, is a past president of the Chicago Branch, former member of the editorial board of PLATING, and is chief chemist at Croname, Inc., Chicago.

CLASS AT TEMPLE UNIVERSITY TECHNICAL INSTITUTE, PHILADELPHIA

A 3-semester course entitled, "Principles and Practice of Electroplating," has been given, since 1950, at Temple University Technical Institute by Dr. Samuel Heiman, chief chemist of Philadelphia Rust-Proof Co., and 2nd vice-president of the American Electroplaters' Society. The object of the course is to provide electroplating personnel and people in allied fields such as metallurgists, electrotypers, and chemical and process suppliers, with a sound understanding of the principles of electrodeposition and the application of these principles to electroplating practice.

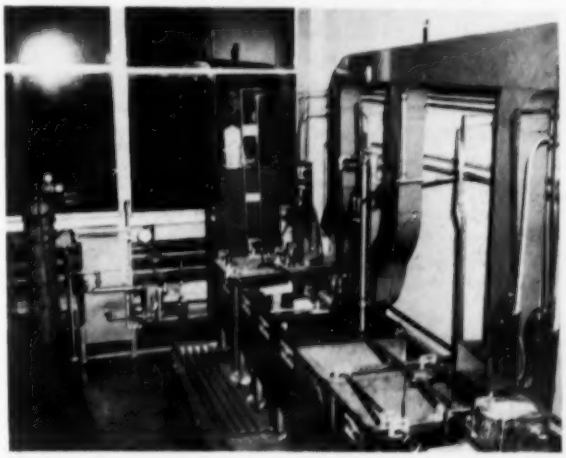
The class meets one evening per week for three hours. The lecture and demonstrations are 1½ hours and the student laboratory is 1½ hours. One semester of sixteen weeks is given each year and the entire course covers three different semesters' work.

Those passing all three semesters of the course are granted a "Certificate of Proficiency" by Temple University Technical Institute.

Subjects discussed in Semester I include: preparation of metal surfaces for plating; types of cleaners for all metals, cleaner function and theory, pickling, hydrogen embrittlement, inhibitors, bright dips, electropolishing. Semester I also includes a number of lectures on plating metals: copper, cadmium, zinc and others. Such lectures consider, in the case of each metal, such things as: application, importance, history, bath compositions, function of constituents, operating conditions, maintenance and control and necessary calculations connected with plating and solution control.

Semester II continues the study of various metal plating solutions in much the same manner, considering the following: lead, tin, nickel, chromium, brass, alloy plating, silver and others.

Another view of the plating room at Illinois Tech



Subjects discussed in Semester III include: principles of chemistry, electricity and electrochemistry, character and distribution of electrodeposits, throwing power, structure of deposits, properties and testing of plated coatings, specifications, corrosion theory, polishing and buffing, plating power sources—motor generators and rectifiers, plating room equipment, etc.

Guest lecturers are invited to speak, and films and plant inspections are part of the course.

As has been mentioned before, laboratory experiments are planned to coincide with lecture material being given. Analysis and control of the electroplating solutions is performed by the students. Hull cells are used for plating demonstrations and experiments. A number of selected laboratory experiments which illustrate the subjects discussed in Semester III have been developed for the course.

Regular chemical laboratory equipment is used for solution analysis. Some specialized plating equipment has been donated to the class by several local plating suppliers.

CLASS AT BROOKLYN EVENING TECHNICAL HIGH SCHOOL, BROOKLYN, N.Y.

The year 1950 was a good year for electroplating classes. In that year, classes were inaugurated at Illinois Institute of Technology, Temple Technical Institute, and also at Brooklyn Evening Technical High School (Fig. 4). The course at Brooklyn Tech, "Principles and Practices of Electroplating," is conducted by Louis Serota who has been an instructor in Industrial Chemistry at Brooklyn Technical High School for 25 years. Unlike the other men who have organized plating classes, Serota is no plater. He learned a great deal about plating before he organized his course.

The course at Brooklyn Tech is a two-year course, offered free as a part of the adult education program of the Evening School Division, Board of Education of the City of New York. Classes meet twice a week for 1½-hour sessions.

Subjects covered are:

FIRST YEAR

Atomic Structure
Calculations for Tank Capacities—Metric System
Specific Gravity
Conversion Factors
Acids, Bases, Salts
Standard Solutions
Standardization of Solutions
Analysis of Acid Copper Bath
Oxidation, Reduction
Analysis of Chromium Bath
Hydrolysis, *p*H, Buffers
Electromotive Series, Galvanic Cell
Analysis of Nickel Bath
Complex Compounds
Analysis of Silver Cyanide Bath
Electrical Circuits, Ohm's Law
Electrochemical Equivalents, Current Density, Current Efficiency
Testing of Electrodeposits

SECOND YEAR

Gravimetric Analysis
Sulfate Determination for Sulfuric Acid in Chromium Bath
Cathode Efficiency Determinations with Copper Coulometer

Louis Serota is shown speaking before his class in electroplating at Brooklyn Evening Technical High School, Brooklyn, N. Y.

Plating Tests with Hull Cell
Buffer Action in Nickel Solutions
Deposition and Corrosion of Metals

The subjects outlined above are covered in lectures, demonstrations, and laboratory experiments. Regular laboratory equipment is available, and small rectifiers and Hull cells are used for plating tests. Metallurgical Laboratory equipment is available for making hardness tests and thickness tests.

Serota stresses the application of chemistry to plating problems. To learn the meaning of experimental evidence, students make up their own plating solutions and analyze them. They also analyze solutions brought to class from the plants in which they are employed. The effect of bath constituents on plating results can be observed by Hull cell tests (Fig. 5).

Films on plating are used as a part of the course. Guest lecturers are obtained frequently to discuss special topics. Inspection trips to plating plants are arranged when possible. Manufacturers' literature which bears on the subjects taught is obtained for distribution to the students.

Serota stresses the value of membership in the AES and attendance at AES branch meetings. He also discusses with his students the value of reference books as well as scientific journals and technical and trade publications.

Graduating students are presented with a Letter of Recommendation.

CLASS AT NEW HAVEN COLLEGE, NEW HAVEN, CONN.

A two-year course in electroplating was organized at New Haven College in 1954 with Edward F. Foley, of Enthone, Inc., serving as instructor (Fig. 6). The course is set up as a four-term course with the following general term topics:

1. Electroplating Fundamentals	15 sessions
2. Chemistry for Electroplating	15 sessions
3. Electroplating Solutions	15 sessions
4. Electroplating Practice	15 sessions

The course was developed to facilitate the training of personnel engaged in plating, by supplementing practical plating experience with an understanding of the theory involved. Classes are held one evening per week for 2 hours. Lectures are supplemented by demonstrations and by laboratory work. Normal lecture room and chemistry laboratory facilities are available. Special equipment is sometimes secured for special demonstrations.

A Certificate is granted to students successfully completing the course.

Subjects to be discussed in the course entitled "Chemistry for Electroplating" are:

1. Introduction to course. Dimensional analysis. How to study for course. Necessary mathematics. Estimation and approximation of answers. Temperature. Density, Concentration. Specific Gravity.
2. Matter. Atomic and Molecular Weights. Chemical symbols. Valence. Calculations for acid-base reactions.
3. (Laboratory) Acids. Bases. Salts. Titration. *p*H.
4. Theory of solutions. Equilibrium. Ionization and Solubility.
5. Complex compounds. Zinc. Aluminum. Tin. Lead.
6. (Laboratory) Solubility. Precipitation. Complex formation.
7. Chemical bonds. Structure of atoms and molecules. Periodic Table.
8. Alkali metals. Copper. Iron. Chromium. Nickel.
9. (Laboratory) Electrochemical Reactions. Corrosion. Oxidation. Reduction reactions.
10. Oxidation—reduction reactions.
11. Electrolysis. Redox potentials. Coulometry.
12. (Laboratory) Electrochemical Cells. Potential Replacement. Electrodeposition.
13. The nonmetals. Anion reactions.
14. Organic Chemistry. Saponification. Surface Tension. Wetting Agents.
15. Review. Discussion of Problems in course.

The 15-meeting course on "Electroplating Solutions" covers the following subjects:

1. Introduction to course. Description of material to be covered. Method of grouping material by subjects—reason for grouping.
2. Cyanide Plating Baths. Characteristics common to cyanide baths.
3. Copper baths.
4. Cadmium and Zinc Solutions.
5. Silver and Brass Plating Baths.
6. Acid Plating Baths. Characteristics common to acid plating baths. Nickel.
7. Chromium.
8. Copper. Zinc.
9. Tin. Iron.
10. Alkaline Plating Baths. Characteristics common to alkaline plating baths. Tin. Lead. Iron.
11. Fluoborate Plating Baths. Common characteristics. Copper. Lead. Tin. Zinc.
12. Alloy plating. Problems of Alloy plating. Lead-Tin. Tin-Zinc. Tin-Nickel. Tin-Copper. Brass.

The electroplating class at Brooklyn Technical High School uses Hull cells for plating experiments in the chemical laboratory.

13. Bright Plating Baths. Theory of bright plating. Copper. Nickel. Zinc. Cadmium.
14. Precious Metal Plating Baths. Gold. Platinum. Indium. Rhodium. Palladium. Electroforming. Hard chromium plating.
15. Review. Question and answer period. Examination.

In considering plating solutions the instructor prepares lectures and simple demonstrations, including the use of slides and films as they are available. Formulas for plating solutions are given, together with an explanation of the simple chemistry of the solutions, sources of impurities, actual bath makeup, and cost per 100 gallons.

The 15-meeting course on "Electroplating Fundamentals" is planned to cover much of the material presented on that subject in "Principles of Electroplating and Electroforming" by Blum and Hogaboom. The 15-meeting course in "Electroplating Practice" is planned to cover the many problems of plating room management and maintenance, including consideration of design and installation problems in a plating plant, bath maintenance, determination of the plating cycle, calculation of the size of equipment required, determination of the processes to be used.

A strong point in the success of the New Haven College Electroplating Courses is the unusually fine cooperation between the college, the instructor, and local industry. The college assigns a Course Coordinator who checks with industries supporting the program to see if students are getting the type of training that is desired, or if other elements should be added to the training program. The Coordinator then works with the course instructor to make the desired changes. Thus, industry feels a closer tie with the program, and supports the course by sending men to attend classes.

CLASS AT CENTRAL SENIOR HIGH SCHOOL, PROVIDENCE, RHODE ISLAND

A two-year course in electroplating has been designed as an apprenticeship training course for the New England Manufacturing Jewelers' and Silversmiths' Association, and established in the Central Senior High School with Joseph A. Smith, Jr., as instructor. Students enrolled in our school attend classes during the working day at their employers' expense. The Providence School Department and New England Manufacturing Jewelers' and Silversmiths' Association provide the facilities and supplies necessary to engage in this endeavor.

The first year course entitled, "The Science and Practice of Electroplating," consists of 4 hours of instruction per week, or 144 hours total, and is conducted (as a lecture and laboratory course) according to the following outline:

1. Registration and Introduction.
2. Principles of Electroplating. Methods of Expressing Conditions of Operation. General Principles. Temperature. Density of Solutions. Composition of Solutions.
3. Principles of Chemistry. Matter. Changes in Matter. Energy.
4. Principles of Chemistry. Chemical Notation. Chemical Calculations. Classes of Chemical Compounds.
5. Principles of Chemistry. Electrolytic Dissociation. Acids. Bases. Salts.
6. Principles of Electricity and Electrochemistry. Electrical Units and Terms. Arrangement of Tanks. Electricity.
7. Principles of Electricity. Faraday's Law. Electrode Potentials. Resistance of Solutions.

8. Factors that Govern the Character and Distribution of Electrodeposits. Mechanism of Electrodeposit. Cathode Film. Structure of Electrodeposit. Properties of Deposit. Effects of Operating Conditions.
9. Governing Factors. Bath Composition. Physical properties of Bath. Basis metals. Throwing power.
10. Preparation for Electroplating. Removal of Greases and Solids. Organic Solvents and Vapors. Alkaline Solutions. Removal of Oxides.
11. Preparation for Electroplating. Pickling Steel. Pickling and Dipping of Copper Alloys. Pickling Zinc and Die Castings. Electropolishing. Mechanical Cleaning.
12. Electrical Equipment. Sources of Current. Types of Current. Current Distribution. Current Measurement. Location of Equipment.
13. Tanks and Equipment. Materials of Construction. Insulation. Agitation. Location of Equipment.
14. Types of Metals and Solutions. The Periodic System of Elements. Composition of Plating Baths.
15. Group 1 B Metals. Copper.
16. Group 1 B Metals. Silver. 17. Group 1 B Metals. Gold.
18. Group 1 B Metals. Gold. 19. Group 2 B Metals. Zinc.
20. Group 2 B Metals. Cadmium.
21. Group 2 B Metals. Mercury.
22. Group 3 B Metals. Aluminum. Gallium. Indium. Thallium.
23. Group 5 B Metals. Arsenic. Antimony. Bismuth.
24. Group 4 B Metals. Germanium. Tin. Lead.
25. Group 6 A Metals. Chromium. Molybdenum. Tungsten.
26. Group 8, Iron Group Metals. Iron. Cobalt.
27. Group 8, Iron Group Metals. Nickel.
28. Group 8, Iron Group Metals. Nickel.
29. Group 8, Iron Group Metals. Nickel.
30. Group 8, Platinum Group Metals. Rhodium, Palladium. Platinum.
31. Group 8, Platinum Group Metals. Rhodium. Palladium. Platinum.
32. Group 8, Platinum Group Metals. Rhodium, Palladium. Platinum.
33. Alloy Deposition. General Principles. Typical Alloy Plating.
34. Buffing. Burnishing. Tubbing. Tumbling.
35. Rack Plating. Rack Design. Special Surface Treatments.
36. Review. Introduction to Control. Testing. Research.

The course for the second year is entitled, "Control and Analysis of Electroplating Baths," and is presented according to the following outline:

1. Student Registration and Introduction to Course.
2. General Principles. 3. Analysis of Solutions.
4. Analysis of Sodium Hydroxide.
5. Analysis of Sodium Carbonate.
6. Analysis of Trisodium Phosphate.
7. Analysis of Sodium Metasilicate.
8. Analysis of Acids. Pickles. Dips.
9. Analysis. Acids or Neutral Baths.
10. Measurement of *p*H. 11. Group 1 B Metals.
12. Copper Analysis 13. Cyanides Analysis.
17. Group 1 B Metals. 18. Gold Analysis.
19. Group 1 B Metals. 20. Silver Analysis.
21. Group 2 B Metals. 22. Zinc Analysis.
23. Group 3 B Metals. Aluminum Analysis.
24. Group 4 B Metals. 25. Tin (stannous, -ic) Analysis.

The electroplating course being conducted at New Haven College by Edward F. Foley consists of lectures, demonstrations, and chemical analysis of solutions in the laboratory. Here Instructor Foley performs a demonstration with a Hull cell to illustrate a point on the subject of the effect of solution impurities on the deposit. (Photos by *Products Finishing*, Cincinnati, Ohio)

26. Group 6 A Metals. 27. Chromium Analysis.
28. Group 8 A Metals. 29. Nickel Analysis.
30. Nickel Baths. Boric Acid Analysis.
31. Nickel Baths. Nickel Chloride Analysis.
32. Group 8 Metals. Rhodium Analysis.
33. Other control and analytical methods. 34. Review.

The instructor, Joseph A. Smith, Jr., suggests that a more complete course, to be considered in the future, might cover 4 years' study consisting of the following general topics:

1. General Chemistry and Basic Electricity.
2. The Science and Practice of Electroplating.
3. Control and Analysis of Electroplating Baths.
4. Research and Plating to Specifications.

The above recommendation would indeed give an individual a thorough, basic training in electroplating, so that he could manage a plating department or operate a plating plant.

RECOMMENDATIONS OF CLYDE KELLY

Since Clyde Kelly was quite active in getting the courses at Illinois Institute of Technology started, he has definite ideas about what such a course should cover. Kelly suggests that a course which is interesting to both the practical plater who knows very little about theory, and the theoretical man who is not acquainted with the practical side can be devised. It can be presented in two semesters (1 year) according to the following outline of subjects:

1. Polishing and buffing; its effect on plating.
2. Discussion on cleaning.
3. Racking, proper positioning of work with respect to anodes. Short discussion of electric current.
4. Copper plating, different types and their uses. Care of baths.
5. Nickel plating, dull and bright. Care of baths.
6. Chromium plating, decorative and hard chromium. Care of baths and anodes.
7. Cadmium and zinc plating.
8. Barrel plating.
9. Anodizing. Other types of plating.

SUMMARY

A brief review of the courses discussed above shows many points of similarity, and some differences (Table I). All of them grant graduates Certificates or Letters of Recommendation. All of them cover both the technical principles of plating as well as the practical aspects—some more in one direction than others. Most of them arrange for guest lecturers on special topics—some more than others. Many of

TABLE I. COMPARISON OF FIVE ELECTROPLATING CLASSES

	Illinois Institute of Technology	Temple Technical Institute	Brooklyn Evening Technical High School	New Haven College	Central Senior High School
Length of Course	1 year	1½ years	2 years	2 years	2 years
Hours Per Week	2	3	3	2	4
Tuition	yes	yes	no	yes	no
Plating Equipment	yes	no	no	no	no
Sponsored by AES Branch	no	yes	no	no	no

them arrange for plant visits to broaden the students' knowledge of the industry.

Although only the course at Temple University Technical Institute is sponsored by an AES Branch, there is close cooperation between the Branch and the course instructor in most cases. The degree of cooperation between the educational institution, the instructor, and local industry varies from course to course, but it exists in all cases.

The course at Illinois Institute of Technology is more actively sponsored by the Chicago Electro-Platers' Institute than by any other agency. Such sponsorship, from whatever source, is important. It would seem desirable for a Branch to sponsor a course, because several instructors report that at least one-third of their students become members of the local branch.

Another important influence is the background and interest of each instructor. Most of the instructors are men with extensive backgrounds in plating backed up by previous training in chemistry and engineering. Although such a background is not entirely essential, it is most helpful.

Another important factor in the continuing success of a course is the type of equipment available. Only the Illinois Institute of Technology has plating equipment of semiplant size, or of a size large enough for actual plating work. Other courses have Hull cells for laboratory work, but in some laboratories there are only facilities for demonstrations by the instructor, while work in the laboratory is limited to chemical analytical facilities. It would seem that some full size plating and polishing equipment would be a necessary adjunct to such a course.

Most instructors make use of the literature distributed by plating supply and equipment manufacturers in addition to standard textbooks such as "Principles of Electroplating and Electroforming," by Blum and Hogaboom and "Modern Electroplating." Excellent films of plating and allied subjects are also available and can be used most effectively.

A few such films and sources are:

"Corrosion in Action"—International Nickel Co.
"Hard Chromium Plating"—Nutmeg Chrome Corp.
"Barrel Plating"—Frederic B. Stevens, Inc.
"Abrasive Belt Polishing"—Behr-Manning Company
"Barrel Plating"—Lasalco, Inc.

A comprehensive list of films has been compiled for the AES Branch Officers' Manual, and will be released when editing has been completed.

RECOMMENDATIONS

Some conception of the tremendous contribution that is being made to the future progress of the Electroplating Industry by these unselfish, dedicated men who are conducting classes in electroplating can be gained when it is pointed out that these men, individually, have had to organize their courses and write their own lectures and laboratory demonstrations and experiments without assistance or collaboration in most cases. Of course they were guided by Blum and Hogaboom, but it is still a tremendous effort for a busy man to take time to organize a complete course. This fact alone has no doubt acted as a strong deterrent to the establishment of similar courses in many cities where it could be of great value to local industry, to the local Branch, and to the National Society. It is to be hoped that the section of the AES Branch Officers' Manual on Classes in Electroplating will contain several standard complete courses of instruction in electroplating and suitable experiments. This would be of great help to anyone wishing to set up such a course. The job of finding an instructor would be made easier.

The Electroplating Industry can be expected to increase in size and importance in proportion to the level of the technical knowledge of the people in the industry. It would seem to be inherent in the purpose, as well as the self-interest, of the leading technical society in this industry to provide a training program to educate the people in the industry, and the people who will become a part of the industry in the future. The opportunity for the AES to make this contribution to the future of the Electroplating Industry is at hand.

ACKNOWLEDGMENT

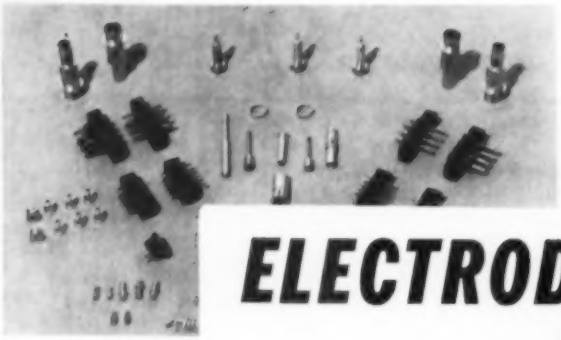
By his purposeful life and by his efforts in the field of education for electroplaters, the late George B. Hogaboom provided the inspiration for this paper.

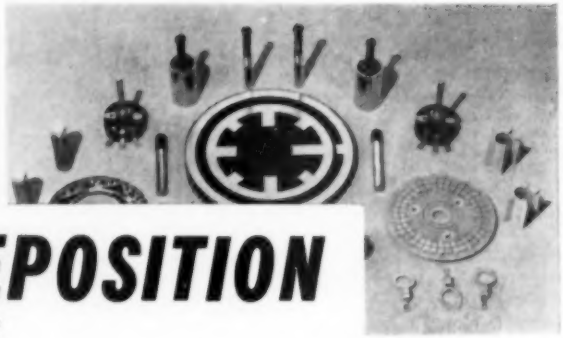
Sincere thanks are due to the following men for their encouragement, assistance, and cooperation in the preparation of this paper: J. M. Andrus, O. F. Dingeldein, E. F. Foley, G. R. Frankovich, Dr. S. Heiman, W. A. Helbig, Clyde Kelly, P. P. Kovatis, G. A. Lux, Louis Serota, Joseph A. Smith, Jr., J. B. Winters.

The author is a graduate of the University of Cincinnati with a degree in Chemical Engineering. Since 1927 he has been associated with the electroplating and finishing industry either as a process engineer, department supervisor, or, since 1948, as Editor of PRODUCTS FINISHING Magazine.

Blount

Long a member of the AES, Blount has been an officer of the Indianapolis Branch, and is a past president of the Cincinnati Branch of the Society. He has served on committees for Cincinnati Branch Annual Meetings and for both Tri-State Regional Meetings. He has just been appointed co-chairman of the host committee for the 1958 Annual Convention of the AES to be held in Cincinnati.





ELECTRODEPOSITION OF RHODIUM

By Edward A. Parker†

ABSTRACT

Factors affecting the deposition of rhodium in thicknesses of 0.000001 to 0.001 inch were studied.

The simple sulfate concentrate plus sulfuric acid gave the best overall results with respect to increased current efficiency, brightness and smoothness of plate, and less sensitivity to additions of other salts and impurities.

Added metallic impurities, Ni, Cu, Cd, Pb, Ag and Sn, with exception of nickel produced harmful effects in concentrations less than 35 milligrams per gallon. Addition of EDTA to the contaminated solutions even at *p*H of 0.5 had some beneficial effects.

Methods of purification are discussed.

Applications which depend on decorative white finish, hardness, corrosion resistance, optical reflectivity, low electrical resistance and combinations are discussed.

INTRODUCTION

Rhodium is one of the most recent of plated metals. Its first commercial application was in the jewelry field in 1930. To the industrial engineer, however, its plating history is in most cases only two to five years old. Although discovered 150 years ago by Wollaston and called rhodium because of its rose red salts and solutions, it found little commercial use in spite of its high melting point, great stability and resistance to corrosion. It is only superficially oxidized at very high temperatures (800° C) in air and is completely inert at normal and moderately high temperatures. It was, also, harder, more wear resistant, whiter and had a higher reflectivity than platinum.

One of the first uses was as a hardening agent in platinum. This type of alloy is still used for contacts on voltage stabilizers. At the present time rhodium has been replaced by ruthenium and iridium as hardening agents for platinum.

The largest use of rhodium at the present time is in the form of a 10 per cent rhodium platinum catalyst for the oxidation of ammonia to nitric acid. In fact practically all of the nitric acid in the world is made by this method. Alloys of this type have found considerable use in the manufacture of textile and glass filaments. Additional uses for this alloy are electrical furnace windings for temperatures up to 1500° F and the Pt–Pt Rh thermocouple is still the most convenient and accurate method of high temperature measurements.

Canadian ores are the largest source of rhodium in the world with South Africa, Russia, Alaska and Colombia following in that approximate order. Usually the rhodium content is one per cent or less of the total platinum metals present.

The sales of rhodium in this country in all its forms is estimated to be 20,000 ounces per year. Of this approximately 70–80 per cent is imported. No data are available but the consensus of opion is that approximately 20 per cent of the rhodium sales are in the form of electroplating concentrates. The only plating baths in commercial use are the phosphate and sulfate and the first patent application for such solutions was made by Shields[1] in October, 1930. An excellent summary of papers published prior to 1940 was that of Weisberg.[2]

EXPERIMENTAL

The high cost of rhodium, $190 per troy ounce (based on price of concentrate), makes it mandatory to operate at as low a metal concentration as is consistent with best operating conditions.

Due to the high purity required and the very limited sources of the metal, rhodium for electroplating is available only in the form of concentrated solutions. Two types of solutions are available: one is a complex phosphate salt of rhodium and varies in composition and properties depending on the manufacturer; the other is the simple sulfate salt of rhodium. The phosphate concentrate can only be diluted slightly with water before some of the rhodium is precipitated. However, as long as the acid concentration is maintained near its original value (*p*H less than two) it can be diluted to any concentration. The sulfate concentrate is, however, stable in dilute solution (to 0.2 grams per liter) without the addition of more free acid.

These concentrates are used as follows:

(1) Phosphate with phosphoric acid;
(2) Phosphate with sulfuric acid;
(3) Sulfate with sulfuric acid.

Data on the phosphate and with added phosphoric acid will be described first.

CONCENTRATION

Figure 1* indicates how the increase of rhodium from 8 to 20 grams per gallon (2 = 5.3 g/l) affects the current efficiency.

*Note: In this graph and all others that follow through Fig. 19 all points are the average of four to six determinations derived from two to three different solutions.

†Technical Director, Technic, Inc.

Note: In commercial practice the mixed units grams of rhodium per gallon are used almost exclusively. Therefore these units will predominate in this discussion. The corresponding grams per liter will be given in parenthesis.

The acid concentration is 150 ml phosphoric acid per gallon (40 ml/l) which is normal for most phosphate baths used for decorative plating.

Figure 2 demonstrates the decrease in current efficiency for the same solutions when no mechanical agitation was used. Raising the metal concentration 2½ times increases the rate of deposition two fold with agitation and approximately three fold without agitation. The effect of agitation is much more at low current density and is almost nullified at high current density due to the agitation caused by the evolution of hydrogen.

ACID CONCENTRATION

Figure 3 demonstrates the effect of increasing acid concentration at one of the more commonly used current densities, 23.2 asf. The bottom curve is the 8 gram per gallon (2 g/l) solution. The next is 14 grams and the top is 20 grams per gallon. All solutions were agitated. In general current efficiency continues to decrease as acid concentration increases. The effect is less at low metal concentration. Data at very low acid concentration, less than 100 ml per gallon, only partially plotted in the graph, indicates an enormous decrease with the initial acid buildup. The resultant plates, however, are streaked, gray and with a high tendency to burning and thus were omitted.

Figure 4 shows the same effects for nonagitated solutions. In general the same remarks apply but the rates are slower.

TEMPERATURE

Figure 5 demonstrates the large increase in current efficiency as the temperature is increased from 75 to 130° F in a solution containing 12.9 grams rhodium per gallon. In most cases there is a levelling off in rapid rate increase when the temperature reaches 110°. For the higher current densities the temperature is 120° F.

CURRENT DENSITY

The effect of current density is demonstrated a little more clearly in Figure 6. The decrease is very rapid at low current densities and then flattens out at the higher current densities.

AGITATION

Comparison of Figures 1 and 2 demonstrates the increasing effect of agitation as the current density is decreased.

EFFECT OF ADDED SALTS

With phosphate solutions most of the studies on added salts have been with the 8 gram per gallon solution, flash deposits, and a phosphoric acid concentration of 150 ml per gallon.

The effect of ammonium salts on phosphate solutions is tabulated in Table I. The diammonium phosphate neutralized some of the free acid but additional acid was added to compensate.

Addition of sodium chloride had no appreciable effect on current efficiency or on the appearance in amounts up to 2.0 grams chloride per gallon (0.5 g/l). Silver added in the form of potassium silver cyanide had an effect on the color initially but after an hour or so no noticeable effect could be found. Evidently the cyanide was liberated as HCN and most or all of the silver precipitated. A precipitate was obtained with only 1.6 mg silver per liter.

Processing items containing iron (steel springs) gave rise to the formation of a heavy yellow precipitate of ferric phosphate. For flash work enough iron did not remain in solution to materially affect the color of the plate.

TABLE I. EFFECT OF AMMONIUM SALTS ON CURRENT EFFICIENCY OF PHOSPHATE SOLUTIONS

8 grams Rhodium per gal
150 ml Phosphoric acid per gal
120° F No Agitation

asf	Diammonium phosphate added: 0 oz/gal	6.8 oz/gal	14 oz/gal
11.6	22½% C E	15% C E (Bright 10 min)	9% C E
23.2	18% (Burnt 5 min)	9% (Bright 10 min)	6%
46.4	13% (Burnt 4 min)	5.5% (Bright 10 min)	3%
93	9% (Burnt 4 min)	4% (Bright 10 min)	1%

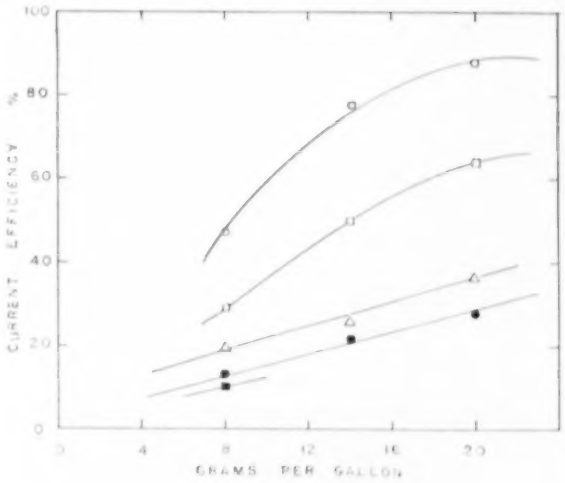


Figure 1

Effect of concentration of rhodium on current efficiency in agitated phosphate solutions. Acid concentration—150 ml 85% phosphoric acid per gallon (39.6 ml/l). Temperature—120 F

○ = 11.6 asf
□ = 23.2 asf
△ = 46.4 asf
● = 69.6 asf
■ = 92.8 asf

SULFATE

These studies were then repeated using a concentrate of rhodium sulfate and sulfuric acid.

Figure 7 demonstrates the relationship between increasing concentration of rhodium and current efficiency at several current densities. In general the rate of deposition is much higher than the corresponding phosphate solution. In addition the heavy plates are much brighter for a given current density.

Figure 8 indicates the same type of results with nonagitated sulfate solutions.

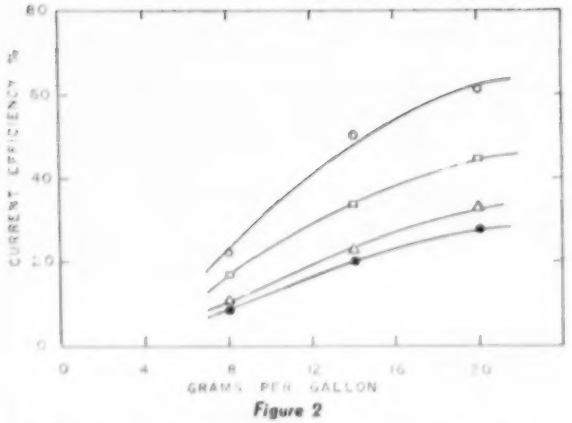


Figure 2

Effect of concentration of rhodium on current efficiency in nonagitated phosphate solutions. 150 ml 85% phosphoric acid per gallon (39.6 ml/l). 120 F
○ = 11.6 asf
□ = 23.2 asf
△ = 46.4 asf
● = 69.6 asf

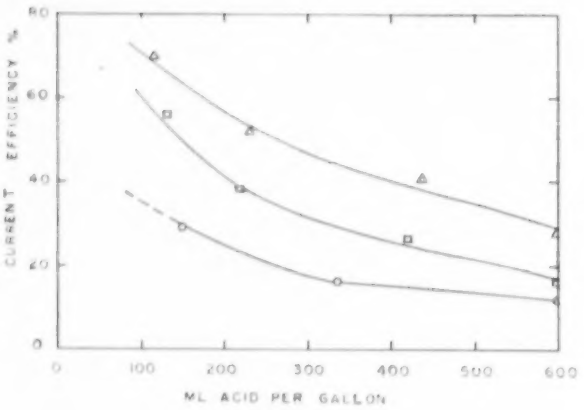


Figure 3

Effect of phosphoric acid concentration on the current efficiency of agitated phosphate solutions. 23.2 asf 120 F
○ = 8 grams rhodium per gal (2.1 g/l)
□ = 14 grams rhodium per gal (3.7 g/l)
△ = 20 grams rhodium per gal (5.3 g/l)

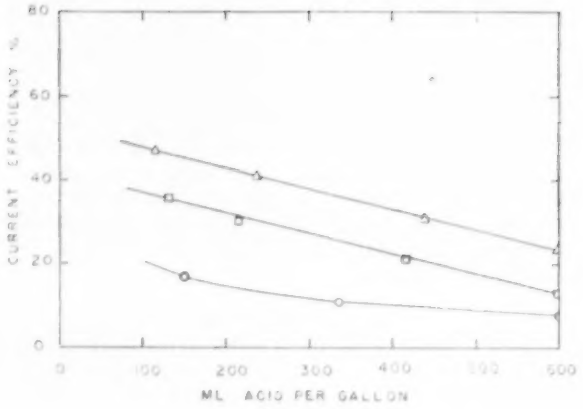


Figure 4

Effect of concentration of phosphoric acid on the current efficiency of nonagitated phosphate solutions. 23.2 asf 120 F
○ = 8 grams rhodium per gal (2.1 g/l)
□ = 14 grams rhodium per gal (3.7 g/l)
△ = 20 grams rhodium per gal (5.3 g/l)

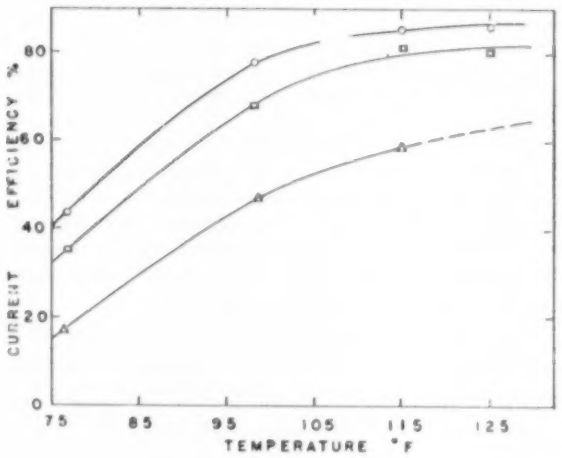


Figure 5

Effect of temperature on the current efficiency of agitated rhodium phosphate solutions. 12.9 grams rhodium per gal (3.4 g/l). 150 ml phosphoric acid per gal (39.6 ml l)
○ = 5.75 asf
□ = 9.6 asf
△ = 19.2 asf

Figure 9 demonstrates the effect of increasing acid concentration on current efficiency for three rhodium concentrations and one current density. The effect is much less than in corresponding phosphate solutions.

The effect of increasing temperature is demonstrated in Fig. 10. The solution chosen for this set of curves may be called the equivalent of a well worked solution—moderate acid concentration (200 ml/gal) and considerable ammonium salts (17 oz/gal). The effect of increasing current density is presented in Fig. 11. As would be expected the changes are largest for the less concentrated solution. At 30 grams per gallon the current efficiency remains above 90 per cent from 5 to 40 asf. Agitation has its greatest effect at low current density. Above 50 asf the agitation caused by gas evolution approaches that produced by mechanical agitation.

For the practical plater Fig. 12 was plotted. The "time to plate 0.0001 inch" from sulfate solution of several concentrations was plotted against current density. The decrease in time obtained by raising the 20 gram concentration by 50 per cent was small compared to the increase in drag-out losses. The more concentrated solution does, however, have an advantage in plate characteristics for deposits of 0.0005 inch or more.

ADDITION OF AMMONIUM SALTS

The addition of ammonium salts to 20–23 gram per gallon rhodium sulfate solution had some brightening action. As the temperature was decreased however, ammonium salts had an increasingly detrimental effect on the current efficiency. At 75° F, 17 oz ammonium salt per gallon reduced the current efficiency 40 per cent in agitated solutions at current densities greater than 20 amperes per sq ft.

With no agitation the negative effect was much smaller. Increased acid concentration also tended to nullify the effect

of ammonium salts. At 120° F and low amperage (10 asf) the current efficiency was slightly increased by addition of ammonium salts. Above 20 asf the effect was slightly negative unless the acid concentration was increased to 300 ml per gallon.

Fink and Lambros in 1933[3] found that an ammoniacal

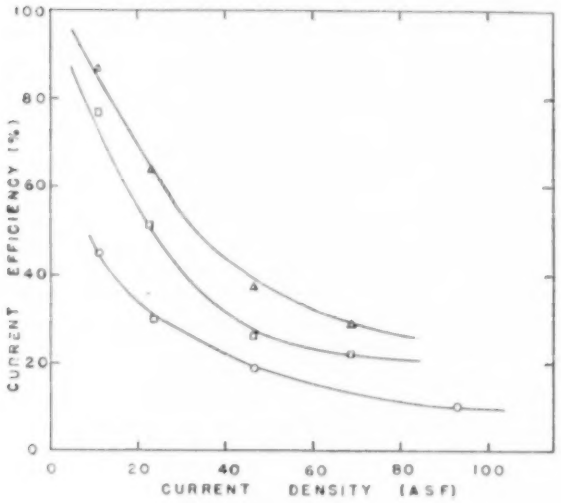


Figure 6

Effect of current density on the current efficiency of agitated rhodium phosphate solutions. 120 F. 150 ml phosphoric acid per gal (59.6 ml/l).
○ = 8 grams rhodium per gal (2.1 g/l)
□ = 14 grams rhodium per gal (3.7 g/l)
△ = 20 grams rhodium per gal (5.3 g/l)

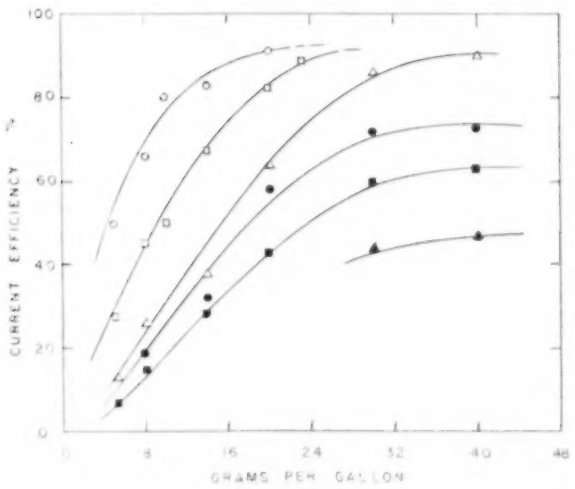


Figure 7

Effect of concentration of rhodium on the current efficiency of agitated sulfate solutions. 120 F. 100 ml sulfuric acid per gal (26.4 ml/l).
○ = 11.6 asf
□ = 23.2 asf
△ = 46.4 asf
● = 69.6 asf
■ = 92.8 asf
▲ = 139.2 asf

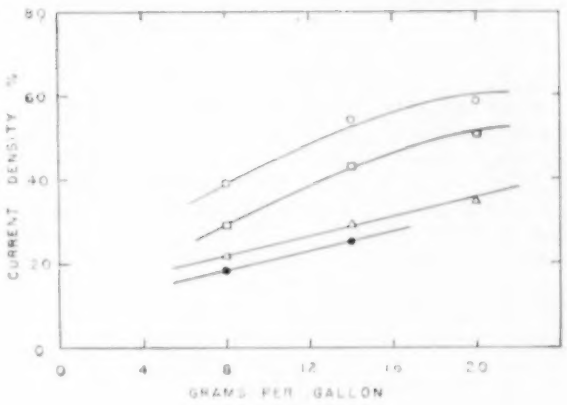


Figure 8

Effect of concentration of rhodium on the current efficiency of nonagitated sulfate solutions. 120 F. 100 ml sulfuric acid per gal. (26.4 ml/l).
○ = 11.6 asf
□ = 23.2 asf
△ = 46.4 asf
● = 69.6 asf

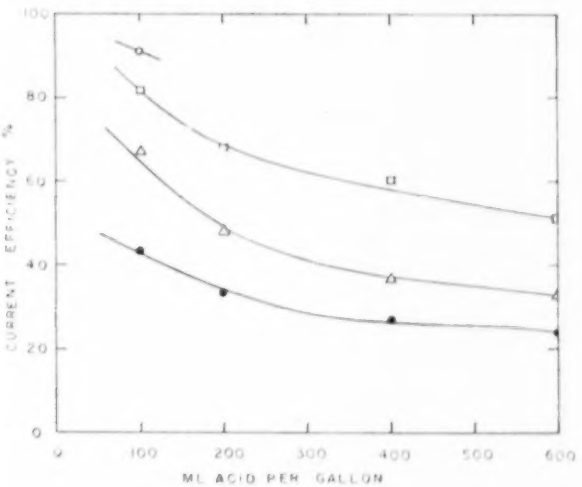


Figure 9

Effect of concentration of sulfuric acid on the current efficiency of agitated rhodium sulfate solutions. 120 F. 23.2 asf
○ = 30 grams rhodium per gal (7.92 g/l)
□ = 20 grams rhodium per gal (5.3 g/l)
△ = 14 grams rhodium per gal (3.7 g/l)
● = 8 grams rhodium per gal (2.1 g/l)

precipitate of rhodium dissolved in sulfuric acid (15 g/gal) and an additional 3.8 oz of ammonium sulfate per gallon gave the whitish flash plates of any of the rhodium solutions they prepared. At low rhodium concentrations there is a slight brightening effect but no thorough study of effect on current efficiency has been made.

ADDITION OF METALLIC IMPURITIES

Very little information has appeared in the literature on the effect of metallic impurities in rhodium solutions. Wiesner[4] found, in a 37 gram per gallon solution, that nickel has had no effect up to 2.0 g/gal; silver caused spongy plates due

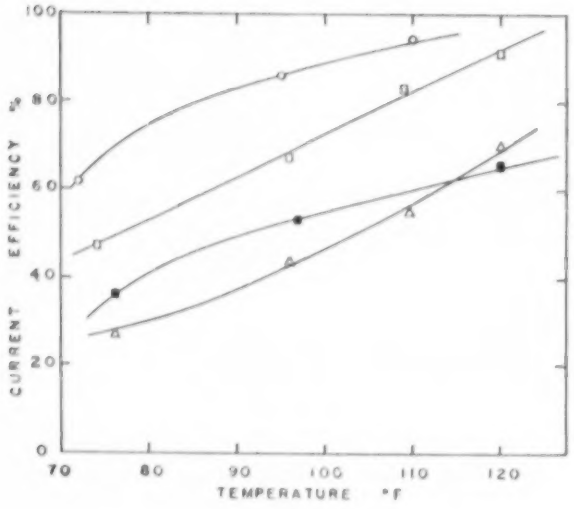


Figure 10

Effect of temperature on the current efficiency of agitated rhodium sulfate solutions containing 17 oz ammonium sulfate per gal, 23 grams rhodium per gal, 200 ml sulfuric acid per gal. (52.8 ml/l)
○ = 5.6 asf
□ = 11.6 asf
■ = 11.6 asf—No agitation.
△ = 23.2 asf

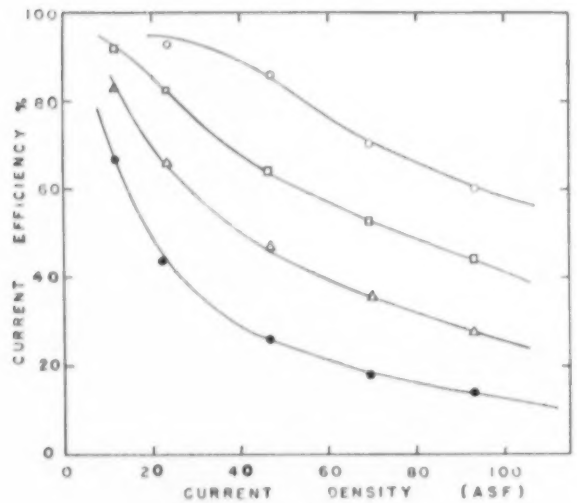


Figure 11

Effect of current density on the current efficiency of agitated rhodium sulfate solutions. 120 F. 100 ml sulfuric acid per gal (26.4 ml/l).
○ = 30 grams rhodium per gal (7.9 g/l)
□ = 20 grams rhodium per gal (5.3 g/l)
△ = 14 grams rhodium per gal (3.7 g/l)
■ = 8 grams rhodium per gal (2.1 g/l)

to immersion plating on brass and copper, as also, did mercury; iron had no effect in amounts up to 2.0 g/gal but that ferrocyanide reduced the efficiency to zero.

Brenner and Olson[5] found that 0.25 gram zinc per gallon reduced the reflectance from 75 to 69 per cent and that iron in amounts of 38 mg/gal had no effect. These data were for solutions containing 4 to 8 grams rhodium per gallon and were used for flash plates on reflectors. Laister[6] tested the

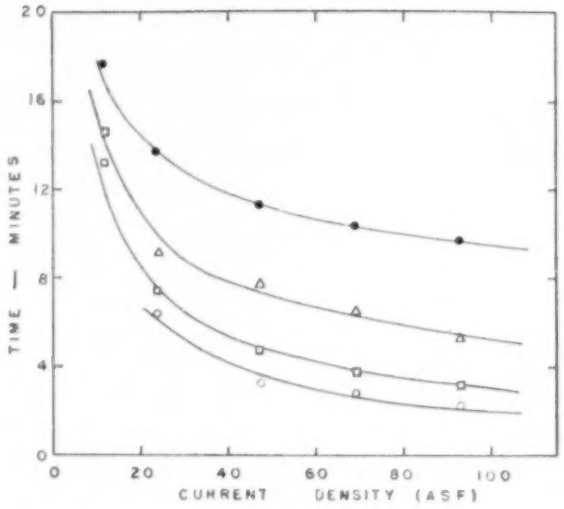


Figure 12

Effect of current density of the time required to plate 0.0001 inch in agitated rhodium sulfate solutions. 120 F. 100 ml sulfuric acid per gal (26.4 ml/l).
○ = 30 grams rhodium per gal (7.9 g/l)
□ = 20 grams rhodium per gal (5.3 g/l)
△ = 14 grams rhodium per gal (3.7 g/l)
● = 8 grams rhodium per gal (2.1 g/l)

effect of copper, mercury, nickel, silver, tin and zinc on plates 0.000017 inch thick plated from a 15 g rhodium per gallon at 95° F. He found 3.8 gram of copper per gallon brightened the plate and that lesser amounts had no effect; 38 milligrams mercury per gallon had some brightening effect and 380 mgs and over produced dark streaks. Nickel in amounts up to 3.7 gram per gallon had no effect. Silver produced some brightening at 37 mg/gal while 380 mg/gal produced dark to black streaks. Higher amounts produced nonadherent deposits.

Tin in amounts 38 to 380 mg per gallon produced bright deposits; 0.75 grams per gallon produced dark streaky deposits while 3.8 grams per gallon produced a black glossy plate which was not changed by polishing. Zinc had no effect in amounts to 38 mg/gal but 380 mg per gallon produced dark streaky plates. Reid[7] described the use of 3.8 to 75 mg lead per gallon as a brightening agent for rhodium solutions containing 2.0 to 20 grams rhodium per gallon. The maximum deposit thickness was 0.000050 inch and the current density was limited to 20 to 40 asf while the temperature is preferable less than 100° F.

Since most of above work, with the exception of Wiesner, was on flash plates, less than 0.000020 inch, the following studies were made. The rhodium solution tested for the effect of metallic contamination contained 14 grams rhodium and 600 ml sulfuric acid per gallon. The test plates, 0.000050 to 0.0002 inch, were made at 120° F from 11 to 46 amperes per sq ft with and without mechanical agitation. The test panels were polished brass discs, 1⅜ inches in diameter and flashed with 24 K gold to maintain a clean reproducible surface between cleaning, drying, possible standing overnight or longer, weighing, brief electroclean rinse, acid dip rinse and then enter rhodium solution.

The metal ion contaminate was added in the form of a sulfate solution containing 3.78 grams metal per gallon until a 0.0001 inch plate was rough to touch, or streaked, and/or dark matte finish would finger print stain very easily. Such

a stain was defined as that which would remain visible for more than two hours. Such stains would usually be black the next day.

The stannous sulfate solution required 20 ml of sulfuric acid per gallon to remain stable for one week.

COPPER

Four to 20 milligrams copper per gallon gave a slight improvement in appearance; 20 to 30 mg copper per gallon was the maximum amount permissible. As the amount of copper was further increased, the plates became more milky, and then matte with a brownish cast. No changes were noticed in current efficiency for 11 to 50 asf with agitation and 23 asf without agitation for 0—200 mg Cu/gal. The color of the solution materially darkened and when measured at 450 ml has the same absorbency as a solution twice as concentrated with respect to rhodium.

SILVER

Four mg Ag/gal was the maximum amount permissible. At 20 mg/gal black pinpoint spots developed on the plate in a few hours after removal from plating solution. No change in current efficiency was detected with 100 mg Ag/gal. On standing, this solution had a slight white precipitate and the solution was much darker with a greenish cast than the above copper contaminated solution. Measurement at 450 ml indicated three times absorbency as the noncontaminated solution.

TIN

The maximum permissible Sn^{--} content was 20 mg per gallon. The characteristics of this impurity was a speckliness of the plate. Under magnification it looked as if the tin was plating out in irregular areas. At 100 mg/gal and above the plates at 11.6 asf were rough to the touch. Higher current densities gave smooth but mottled plates. This was present even at 50 millionths inch plate. No changes were noticed in current efficiencies up to 400 mg Sn^{--} per gallon.

LEAD

The addition of four milligrams of lead per gallon improved the appearance somewhat while 12 to 20 milligrams per gallon had a definite darkening effect. At 20 mg/gal there was a slight roughness at 11.6 asf but at higher current densities the plate was still passable. At lower temperatures 70–90° F. lead appeared to have less detrimental effect but suitable plates over 0.000050 inch could not be produced.

No changes in current efficiency were found up to 100 mg lead per gallon. No color change was found in the plating solution.

CADMIUM

Twenty milligrams of cadmium per gallon was the maximum amount permissible. Amounts up to 100 mg per gallon had no effect on current efficiency but did produce brown to dark discolorations of the plate. There was no effect on the color of the solution.

NICKEL

Two grams nickel per gallon was the maximum amount permissible. Four grams per gallon gave a "milky" plate at 11 asf and a matte gray plate with a dark cast at 46 asf. The current efficiency was not changed at 11 asf up to 8 grams nickel per gallon but at 46 asf the efficiency dropped 25 per cent. The color of the solution had a greenish cast but color measurement at 450 ml indicated only a 20 per per cent increase in color.

DILUTE SOLUTIONS

Impurities in dilute rhodium solutions used for flash plates have much less effect. Whereas above it was demonstrated that 20 milligrams of silver per gallon produced plates which developed black pinpoints in several hours, it was possible to add 150 milligrams of silver in the form of a silver plating solution with no noticeable effect on flash plates. Much of the silver had, however, precipitated. After a total of 500 mg of silver per gallon had been introduced into the solution, the flash plate had blue streaks and the overall effect was quite dark in spite of a very large amount of precipitate. Further standing at 120° F for one to two weeks did not improve the plating characteristics of the solution.

The addition of nickel to dilute solutions had very little effect. For decorative purposes, solutions containing 4 to 8 grams of rhodium per gallon have been used even though the nickel content was as high as 8 grams per gallon. With the advent of bright nickels the drag in of nickel solution usually results in streaked plates or in the reduction of rhodium to a mirror deposit on the tank walls or as a fine sooty deposit all of which are due to the nickel brighteners and not to the nickel ion.

Some miscellaneous observations on the dilute rhodium solutions were the following:

The deposition of rhodium mirrors in glass tank walls or deposition of black powdery rhodium has also been produced by the drag in of organic contaminates such as cleaning solutions, soaps, lacquer and also to powdered zinc or tin on poorly cleaned castings.

Zinc diecasts that are exposed through pores in the nickel plate or too thin plates in the recesses will deposit black spongy rhodium in situ through local cell action.

The first plates from a solution contaminated with 400 mg per gallon of potassium ferrocyanide were only partially covered but later more and more areas would plate probably due to a very slow breakdown of the ferrocyanide. Small amounts of selenite also produced the same spot plating along with a reduction in current efficiency. With further additions blue streaks were obtained in the plates. The drag in of small amounts of gold plating solution to the same solution reduced the apparent efficiency to one per cent. A week later the efficiency was still 1-2 per cent. The color of the plate in both cases was blue with good acid resistance but was converted to a gold color in a cathodic cleaner. A blue precipitate (ferrocyanide) settled out of the plating solution on standing and even a week later the same blue-gray colored plates were obtained.

The addition of a gold cyanide solution to the same type of rhodium solution also had some of the above effects. Spot plating was obtained with 0.15 gram gold per gallon with a 50 per cent decrease in current efficiency. On standing a day, the solution returned almost to normal. Increasing the gold concentration to 0.45 gram per gallon reduced the current efficiency to one per cent with spot plating which slowly recovered after standing several weeks.

To summarize it would appear that as the thickness of plate is increased the effect of metallic impurities becomes more important. Twenty milligrams per gallon of lead, tin, copper and cadmium are the maximum amount permissible for plates in thickness of 0.0001 inch. Zinc will probably be in this classification on extrapolation of the results obtained in

flashing solution. Silver must be less than ten milligrams per gallon. Nickel is permitted in amounts of 1.0 grams per gallon.

COMPARISON OF SULFATE AND PHOSPHATE SOLUTIONS

In general, the sulfate solution has the best performance record. Brighter plates are obtained over a wider range of current density, temperature, concentration and thickness of deposits.

Usually it requires only one half the time in a sulfate solution to produce equivalent thicknesses.

Increasing acid concentration has a much greater effect on the phosphate solutions especially in the increase of time required for a given thickness. Also it would appear that ammonium ion concentration has a much greater effect on the phosphate solutions. It is true that the data with the phosphate solutions are only at low rhodium concentrations but the effect is 50 to 100 per cent and it is always negative. In the concentrated sulfate solutions, the effect is small, usually 10 to 25 per cent.

With the 8 gram solution the maximum thickness is 30 millionths inch for bright plates. With a concentration of 14 grams per gallon it is somewhat difficult to obtain even a semi-bright plate 0.0001 inch in thickness from a phosphate solution. The corresponding sulfate solution has some latitude, i.e., greater range of acid concentration and current density. At 20 grams per gallon in a phosphate solution it is preferable not to plate more than 0.0001 inch while such concentrations in sulfate solutions are used in production for 0.0001 to 0.0005 inches. Particulars for each solution are summarized in Table II.

BARREL PLATING

There are no data in the literature on the barrel plating of rhodium. A few scattered reports of poor results have come from industry. In the jewelry field some basket work has been done and is being done. However, considerable rhodium is lost in the basket itself. Using an auxiliary anode over the top of the basket and no tank anodes helped considerably but in no way could be used for specification work. Using new small commercial available barrels (10–20 in^3) excellent results were obtained in 4 to 8 grams rhodium per gallon solutions. As the temperature was reduced the color was darker in tone. Current density range was 10 to 30 asf.

Some typical results are listed in Table III.

TABLE II. SUMMARY OF RHODIUM PLATING DATA

Temperature 120° F Mechanical Agitation

Concentration	Phosphate	Sulfate
	50 millionths	
8 grams/gallon	200 ml acid/gal (min)	100 ml acid/gal
	11–25 asf	11–60 asf
	16–12 minutes	8–6 minutes
At 600 ml acid/gal	37–18 minutes	14–7 minutes
14 grams/gallon	200 ml acid (minimum)	100 ml acid
	10–25 asf	10–60 asf
	10–8 minutes	7–4 minutes
	0.0001 inch	
	300 ml acid (minimum)	200 ml acid/gal
	10–25 asf	10–25 asf
	24–18 minutes (maximum thickness)	18–8 minutes
At 600 ml acid/gal	50–25 minutes	24–12 minutes
	0.0001 inch	
20 gram/gallon	200 ml acid (minimum)	100 ml acid/gal
	10–23 asf	10–30 asf
	15–10 minutes (maximum thickness)	14–8 minutes
At 600 ml acid/gallon	26–30 minutes	17–8 minutes

APPLICATIONS

DECORATIVE:

The pleasing white color of rhodium (only slightly bluer than silver) has created a considerable demand for its use as a nontarnishing decorative finish. In fact the first commercial use of rhodium plating in 1931 was in the jewelry field and until the last few years the major portion of electroplated rhodium was in this field. In general, the thickness of plate ranges from 0.000001 to 0.000005 inch. The usual base plate is nickel or silver.

TABLE III. BARREL RHODIUM PLATING

	Typical Results			
Rhodium Concentration, g/gal	8.0	7.0	4.0	3.5
Sulfuric Acid, ml/gal.	100	100	120	120
Temperature, ° F.	120	80	115	105
Current Density, asf	15.0	14.9	14.9	14.9
Time, minutes	32	37	3.0	30
Current Efficiency, per cent.	31	13.2	15.7	10.5
Thickness, x 10^{-4} in.	1.08	0.52	0.05	0.34

In the communication industry, thin coatings, 0.000010 inch or less, are used both to prevent oxidation of the silver plated surface and to give an attractive finish.

ELECTRICAL CONTACTS

The three main factors for the use of rhodium on electrical contacts are:

(1) wear resistance
(2) corrosion resistance
(3) electrical conductivity

High wear resistance is essentially based on the extreme hardness of electroplated rhodium—namely 800 diamond pyramid which is in the range of hard chromium. If high contact pressure is required then it is advisable to plate a hard metal, i.e., nickel, underneath the rhodium rather than a soft metal such as silver. Radius of curvature of the contact surface or dimple is important to eliminate as far as possible grooving or gouging. As an example it was found that with a dimple with a radius of 1/32 inch or less the wear was on the tube. If the radius of the dimple contact was 3/32 or larger the wear was on the dimple. A radius of 0.10 inch gave good wearing properties on a two-inch cylinder.[5]

As the requirements for longer life or heavier current increases, the thicknesses of rhodium must be increased.

Rhodium is resistant to almost all acids including aqua regia. However, foaming sulfuric acid at 300° F will rapidly attack rhodium sponge. Under normal corrosive conditions so-called tarnishing of rhodium plate is actually oxidation of the basis metal through the pores present in thin rhodium electroplates.

Thus the type of atmosphere will dictate the thickness of rhodium required. An indoor home atmosphere would not attack or corrode a coating of 0.000002 inch while an industrial indoor atmosphere would require 5 to 10 millionths of an inch. In a marine atmosphere it would be best to have the undercoat of silver. As the severity of conditions increases or the base metal activity increases, the thickness of silver must be increased. Coatings on steel should be 0.002 inch and the rhodium 0.0001–0.0002 inch.

To withstand high temperatures nickel is the preferred undercoat. One hour at 923° F (500° C) will produce no change with a base plate of 0.0005 in nickel followed by 50 millionths rhodium while a thinner coating of rhodium (0.000015 inch) was definitely discolored. A silver base of same thickness will give a pattern of general crazing. Less rhodium (0.000015 inch) on a silver base will give dark patches and crazing.[4]

Atmospheres of sulfide or acetic acid require nickel as a base. The electrical resistivity is 4.5 microohms per centimeter which is slightly less than one half that of platinum. Its conductivity is 38 per cent of that of copper. However, more important from an electrical contact view is the *stability* of the low contact resistance. With low voltage contacts the *stability* of contact resistance is even more important as such low voltages will not break through tarnish films. In radio and audio frequency circuits, variation in contact resistance causes spurious signals, and oxide films may cause partial rectification. Another obvious advantage of rhodium in this type of equipment develops when a sliding contact is left in one position for a long time and then is moved. Most other contact surfaces will develop tarnish films which would not give immediate positive contact. Some examples of the above are the following:

(1) Printed circuits are usually plated with nickel and 0.000020 inch of rhodium. The contact is a wiping motion and usually carry low voltage dc with low amperages.

(2) Relays—which carry 10 to 100 ma at 26 volts dc will average 10 million cycles using palladium-gold alloy buttons on both contact surfaces. Similar relays using steel dimple contacts plated with nickel and 0.0001 inch rhodium are regularly passing 15 million cycles.

Magnetic switches using high inductive loads at 28 volt dc and 0.5 ampere requiring life tests of 100,000 cycles or more are plated with a flash of nickel and 0.0001 inch rhodium.

(3) Computer switches running in excess of 1000 rpm using coin silver contacts last only 3 to 4 hours. If these contacts are plated with 0.002 inch bright gold the life is 20 hours. In contrast to this if a nickel flash is plated on the silver followed by 0.0002 inch of rhodium the life is 100 hours or more when used against a palladium alloy rider. The gold would cost three times as much as the rhodium for the thickness described above.

(4) Vibrating contacts of beryllium copper plated with a nickel flash and 0.0001 inch rhodium are used for breaking a 48 volt d-c current of 10 ma 200 cycles per second.

There is no available comparison with gold plated contacts.

OPTICAL PROPERTIES

The reflectivity of electroplated rhodium (Fig. 13) is approximately 75 per cent of silver in the visual range and 80 to 85 per cent in the infra red but while silver rapidly loses its reflective powers due to a tarnish and oxide film-rhodium remains constant.

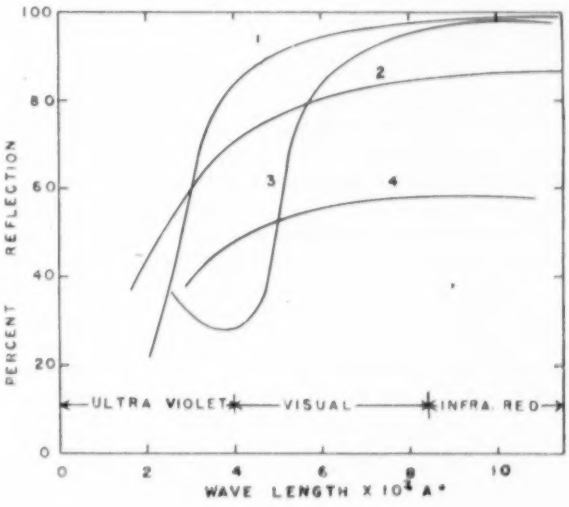


Figure 13

Reflectivity of several metals
1—Silver
2—Electroplated Rhodium
3—Electroplated Gold
4—Chromium

In the infra red range gold is also superior to rhodium but has the disadvantage of being soft and easily damaged.

In addition to constant reflectivity, rhodium has high heat, abrasion and corrosion resistance.

Rhodium has been used since the early 30's for this application.[5,9,15] The coatings are usually less than 0.000005 inch. Lead anodes and sometimes lead-lined tanks are used. However, for heavier coatings, such use is detrimental since particles of lead sulfate become occluded in the plate and cause roughness and porosity. Also as indicated under impurities 38 mg lead per gallon caused matte and rough plates at 50 millionths of an inch.

The type reflectors plated are galvanometer mirrors, spotlight and projector reflectors, searchlights up to 60-inch diameter, automobile and fog lamp reflectors and infra red drying lamps. Rhodium is also put on lenses for 50 per cent transmission by vacuum metallizing. Such a coating is 200 Å or 0.000,000,8 inches thick. The source of rhodium in this process is usually rhodium plated tungsten filaments.

PURIFICATION

The purification of rhodium solutions is in that twilight stage that bright nickels were in in the 30's. It is further complicated by the fact that rhodium is a very noble metal with respect to the electromotive series and thus it has not been possible to plate out metallic impurities at low current density. With nickel there is little loss when nickel in amount equal to or greater than the impurity is plated out. However, in the case of rhodium, the relative costs are, even with $1.50 nickel, 2000 to 1. Thus other methods of removal must be found that are less expensive than refining,. The ferrocyanide precipitation described by Brenner and Olson[5] was primarily used for the removal of zinc. With other metals, precipitation is slow and usually incomplete. In some cases allowing to stand for several weeks completed precipitation and it was possible to use the solutions. Even small amounts of free ferrocyanide, however, are detrimental giving rise to spot plating. Chlorides are removed by addition of a saturated solution of silver sulfate.[4]

With steel articles such as knife blades or steel springs in expansion bracelets it is best to use a phosphate solution. Sulfuric acid acts rapidly on iron and considerable iron stays in solution as the sulfate and thus the plate may contain considerable percentages of iron. In the phosphate solution much of the iron precipitates as ferric phosphate (a yellow brownish precipitate looking like precipitated gold). This can then be removed by filtration and the phosphoric acid replaced. No thorough study has been made of this operation. It is, however, general knowledge that phosphoric acid solutions of rhodium will operate 10 to 20 times as long as sulfate when plating such items.

In the field of organic contamination there is more hope. Activated carbon, Darco S51, has never given trouble through its use in a rhodium bath. The only possible exception to this statement is that it must be completely removed or it will give rough plates as it would in any other plating solution. Others have objected to the heavy absorption of rhodium and still others claim the production of very dark plates. It is possible the latter type of carbon was only alkaline treated and that the acid in rhodium solutions extracted impurities.

The usual organic impurities are wetting agents from cleaners and prior plating solutions, soap from wash off solutions, nickel brighteners, stop off paints, lacquers, etc. Most will cause loss of brightness while some give streaked deposits probably by preferential absorption and then the rhodium attempts to plate over. In many cases rhodium is thrown out of solution by these contaminants as a mirror on the tank wall in much the same manner as silver is deposited by a reducing agent, i.e. formaldehyde. As the layer builds up its adherence becomes poor and flakes off. The activated carbon should be intimately mixed with the hot solution (one half pound per 10 gallons), stirred occasionally for a period of 2-3 hours, allowed to settle and then filtered. Physically absorbed rhodium solution may be leached out using two equal volumes of distilled water. Occasionally excess acid is reduced by neutralization with ammonium or potassium hydroxide. In using ammonium hydroxide the effects of added ammonium salts listed above should be taken into account.

Some attempts have been made to precipitate rhodium as the hydroxide with ammonia, filter, wash and then redissolve in acid. Usually considerable rhodium is lost due to incomplete precipitation.

Potassium hydroxide will give more complete precipitation than ammonia in sulfate solutions. At *p*H = 3, rhodium will start precipitating on standing overnight. At *p*H = 4.0, precipitation is immediate however, even at *p*H = 6.0, only about 90 per cent will precipitate at room temperature.

Raising the *p*H to 11.5 with potassium hydroxide and holding at 150° F for several hours will give 99 to 99.5 per cent precipitation of rhodium. This method, however, does not remove metals whose hydroxides are insoluble in water. The precipitation at 6.0 is more practicable for their removal.

Addition of hydroxides to phosphate solution produced only partial precipitation of rhodium. Gilchrist[11] has indicated that ammonium, nitrates and phosphate ions prevent complete precipitation of rhodium hydroxide. Another variation is to neutralize to *p*H = 4.0, add EDTA to complex the metallic impurities and then raise the *p*H to 11 for complete precipitation of rhodium. The precipitate should then be washed and later taken up in concentrated sulfuric acid. However, an excess of EDTA must be avoided. Four grams excess per gallon of the tetrasodium salt will reduce the current efficiency almost to zero.[12]

In an attempt to evaluate the efficiency of EDTA in complexing metallic impurities in rhodium solutions and thus eliminate the necessity of precipitating rhodium, the free acid, Sequestrene AA, was added to the metallic contaminated solutions listed under effects of impurities. In all cases, except copper, there was definite improvement in plate characteristics when 1.1 grams of Sequestrene AA had been added per gallon. Increasing the EDTA to two grams per gallon produced still further improvement in all cases. With nickel and tin contaminated solutions the plates were bright but with a dark tone. No streaks, grayness or haze were present. Plates from the cadmium contaminated solutions were good while the lead contaminated solution required 2.65 grams EDTA per gallon to give a bright but fairly dark plate.

The silver contaminated sample was restored to a semi-bright plating range while the copper contaminated solutions were aided only slightly at the same concentration.

Although there is no reported complexing of rhodium with EDTA a very decided negative effect on current efficiency was found as the concentration increased over 2.0 grams per gallon. Figure 14 demonstrates this effect for copper, silver and cadmium contaminated solutions together with another solution containing an unknown contaminant. The known contaminated solutions contained 600 ml of acid per gallon while the unknown had only 100 ml per gallon. The low acid curve followed the same pattern as the more strongly acid solutions.

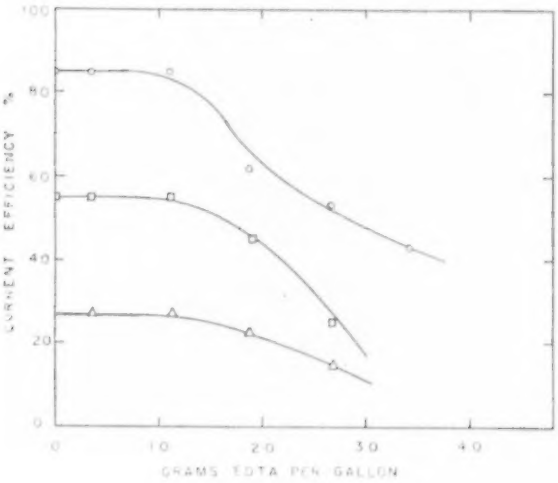


Figure 14

Effect of concentration of EDTA on the current efficiency of agitated contaminated rhodium sulfate solutions. 120 F. 14 grams rhodium per gallon. Contaminates are 0.95 grams cadmium, 0.95 grams copper or 0.95 grams silver per gallon.

○ = 11.6 asf, 100 ml sulfuric acid per gal
□ = 11.6 asf, 600 ml sulfuric acid per gal
△ = 46.4 asf, 600 ml sulfuric acid per gal

Exactly the same type of decline in current efficiency was found for contaminated 20 grams per gallon solutions containing both low and high amounts of acid. The contaminants were lead, tin and nickel. For flashing solutions it would be possible to use this method to hold up the effect of the metallic impurities and thereby use most of the rhodium. For high efficiency baths or where it is necessary to maintain a uniform deposit this method should be used only as a last resort and then limit the EDTA to 2.0 grams per gallon.

WETTING AGENTS

Sodium lauryl sulfate, preferably the USP grade, is the only wetting agent thus far found to be practicable for rhodium solutions.[4] The use of other compounds has usually resulted in black plates. Lauryl sulfate should decompose rather rapidly in strong acid solutions[18] but fortunately does not in rhodium solutions. Even high anode current density (200 asf) used for plating inside of cylinders appears to give no detrimental breakdown products. It is necessary to use the wetting agent (0.1 grams per gallon) in heavy rhodium plating because the bubbles of hydrogen stick very tenaciously especially on sharp edges. Propellor agitation of great speed was not very efficient in dislodging these bubbles; however, tapping will remove them. The wetting agent eliminates the possibility of holes and streaks caused by the adhering gas bubbles. Another very fortunate advantage in using the wetting agent is the sharp reduction in hydrogen spray with entrapped acid and solution when the current density is 20 asf or more.

APPENDIX

Production Plating:

For production work the following four formulations are used:

A. Decorative or Flash

(1) Sulfate
8 grams Rhodium as Sulfate
80 ml Sulfuric Acid
Water to make 1 gallon
Current Density 10–150 asf

This composition is used for flash decorative finish on jewelry and for flash deposits up to 0.000040 inch on industrial equipment for both decorative purposes and for tarnish resistance.

(2) Phosphate
8 grams Rhodium as Phosphate
200 ml Phosphoric Acid
Water to make 1 gallon
Current Density 10–100 asf

The phosphate solution is used mainly for decorative jewelry finishing on items which contain considerable soft solder or are made of steel, tin alloys, or zinc base alloys. This is especially so on deeply recessed items which are difficult to thoroughly cover with bright nickel.

B. Heavy Plate

(3) For thicknesses up to 0.0001 inch use the following:
14 grams Rhodium as Sulfate
70 ml Sulfuric Acid
Water to make 1 gallon
Current Density 10–50 asf

(4) For thicknesses greater than 0.0001 inch use the following makeup:
20 grams Rhodium as Sulfate
60 ml Sulfuric Acid
Water to make 1 gallon
Current Density 10–30 asf

All four of the above solutions are operated at 110–120° F. All the above sulfate solutions will titrate 100 ml sulfuric acid per gallon as there is considerable free acid in all concentrates of rhodium. In preparing any rhodium plating solution fill the plating container one half full with distilled or deionized water. Add the required acid (analytical reagent grade). Mix well and then stir in concentrated solution of rhodium. Then dilute to operating volume with distilled water and mix thoroughly.

All containers or plating tanks for rhodium should be leached with 10 per cent by volume sulfuric acid before use.

Tank materials are usually glass for small volume (4 gallons or less) and plastic lined steel or stainless steel for larger sized (up to 200 gallons). The plastics so far used are sheet Tygon, sheet Koroseal, Saran or hard rubber. Tanks made of Lucite have been used, but the cemented joints are a source of organic contamination and such tanks have to

be carefully and thoroughly leached with dilute acid as should also the plastic lined tanks.

Heavy plates require some form of mechanical agitation to obtain maximum brightness, allow higher current densities and eliminate gray streaks caused by channeling of hydrogen gas across the face of the work. The addition of 5 ml of a one per cent solution of a wetting agent such as sodium lauryl sulfate (USP) per gallon will also reduce gas streaking and pitting due to adhesion of gas bubbles. In addition, the foam blanket formed on top of the surface of the solution during operation will act as a scrubber to prevent the escape of an acid mist.

Special applications such as plating inside tubes, wire plating or plating very short lengths on the ends of contacts will require modifications of the above general operating conditions.

BARREL RHODIUM

For decorative and flash deposits the following solution has been developed in this laboratory:

4 grams Rhodium as Sulfate
100 ml Sulfuric Acid
Water to make 1 gallon
Current Density 10–30 asf

At 110–120° F a three minute plate at 15 asf will give a thickness of 0.000005 inch.

For production plating of thicknesses over 0.000050 inch it is recommended that the more concentrated bath listed below be used:

8 grams Rhodium as Sulfate
100 ml Sulfuric Acid
Water to make 1 gallon
Current Density 10–20 asf

At 115–120° F and 15 asf 0.0001 inch will be deposited in 10 minutes. Reduced current densities (less than 10 asf) will give much darker plates and this effect is considerably increased at lower temperatures. Phosphate solutions require much higher voltage and also plates slower in conformance with the data on tank plating.

ANALYTICAL

The preferred method for determining rhodium in solution used for the heavier deposits is the electrogravimetric one. The solution cannot contain more than a few per cent of foreign metals or the characteristics of the plate fall off rapidly.

(1) Transfer 25 ml sample of a 20 gram per gallon solution (100–150 mg) to a 250 ml electrolytic beaker (high form).
(2) Dilute to 80 ml with distilled water.
(3) Adjust spiral platinum anode and weighed platinum gauze cathode.
(4) Lower into solution and adjust current to 2.0 amperes.
(5) Cover with split watch glasses.
(6) After 1 to 2 hours rinse down walls and glasses with a fine stream of water.
(7) Adjust current to 1.0–1.2 amperes and allow to run overnight.
(8) Rinse down walls and glasses and plate for one hour additional at 2.0 amperes.
(9) Remove from cell before breaking current.
(10) Wash off thoroughly. Dip in alcohol.
(11) Dry at 220° F for 10 minutes.
(12) Allow to cool and weigh.
(13) Gain in weight x 151.4 = grams Rhodium per gallon.

NOTE—(1) If some means of agitation is available such as a magnetic stirrer use 5–6 amperes for one hour. Rinse down and run one additional hour. No heating is required for either method.

NOTE—(2) Precipitation with C P Zinc dust may also be used to produce metallic rhodium which can be washed, dried and weighed.

ACID DETERMINATION

(1) Transfer one ml of plating solution (5 ml of flashing baths—low rhodium content) to a 250 ml Erlenmeyer flask.
(2) Add 60 ml water and two drops of methyl orange. Mix.
(3) Titrate with 0.1 N sodium hydroxide to color change for red to orange.
(4) M 10.1 N x 10.8 = ml sulfuric acid per gallon.

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DR. EDWARD A. PARKER

Parker

Dr. Edward A. Parker obtained his education at the University of Illinois where he received the degrees of B.S. in 1930, M.S. in Organic Chemistry in 1932 and Ph.D. with thesis on X-ray diffraction in 1937. Following appointments as Textile Foundation Fellow (1935–1937), with Long Island Biological Association (1937–1939) and as Atlas Powder Fellow (1939–1941), he entered the plating field in 1941 when he joined the consulting firm of A. Kenneth Graham and Associates. He then became associated with Alrose Chemical Company, which he left for his present position as Technical Director of Technic, Inc. since 1945. Dr. Parker is an active member of the Providence-Attleboro Branch, AES, serving in the capacities of Secretary-Treasurer, President and Paper Awards Committee.

He is a member of the Research Project Subcommittee No. 12 from inception to date; Editorial Board and Research Committee; and received the AES Gold Medal Award in 1952.

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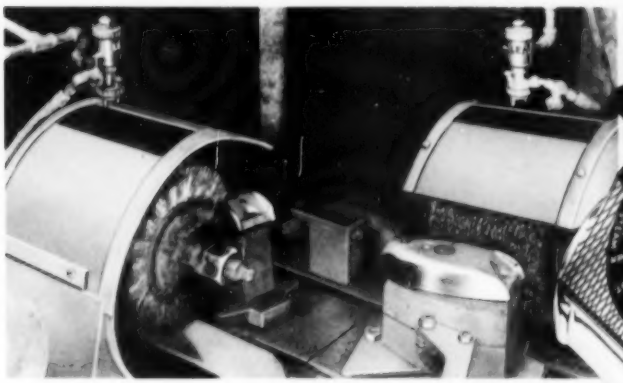
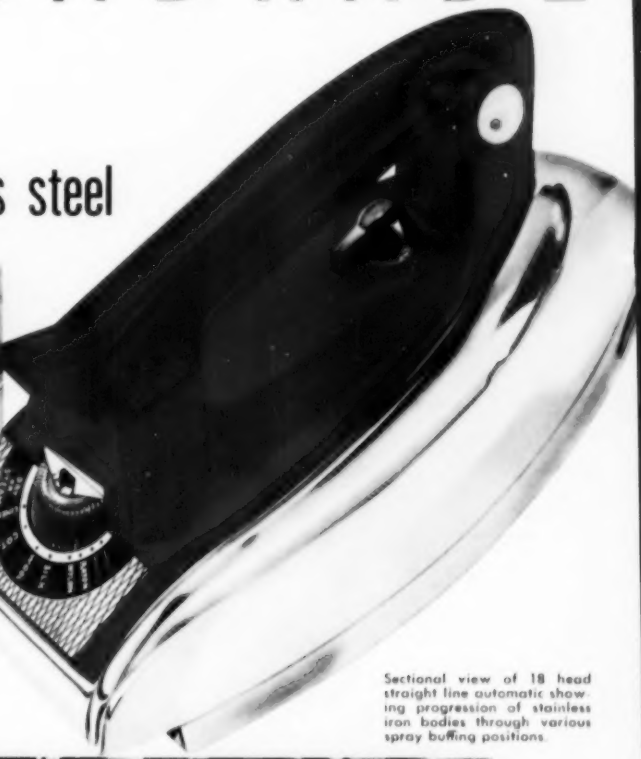


Close up of Lea-Engineered Spray Buffing System using Lea Liquabrade on side buffing



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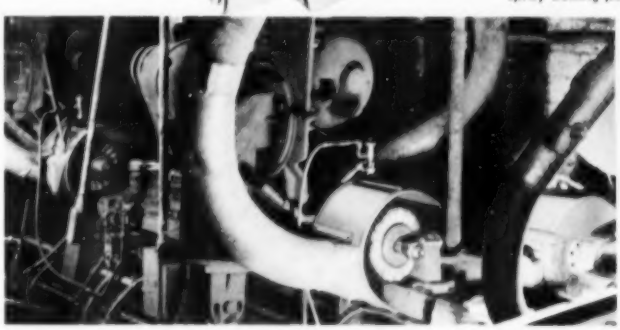

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aes research project no. 12

Cleanability and Oil Spreading Rates†

By HENRY B. LINFORD* and PAUL E. GRUBB

ABSTRACT

The object of this study was to develop a correlation between the spreading rate of various oils, fats and greases (which are solid at room temperature) on a particular metal with the cleanability or difficulty of cleaning that soil from another metal. This would allow spreading rate studies of corrosive soils to be made on corrosion resistant metals.

In previous work, a very good correlation was obtained between cleanability and oil spreading rate, using oils which were in the liquid state at room temperature. This work has been extended to include soils that are solid at room temperature.

INTRODUCTION

Satisfactorily clean metallic surfaces are essential to successful electroplating, anodizing, painting and other finishing operations. Generally, overcleaning is resorted to in order to ensure the presence of a satisfactory clean surface. If there were a correlation between spreading rates and cleanability of oils, fats and greases, the metal finisher would be able to predict the approximate time of cleaning by knowing the spreading rate of the oil which he wishes to remove.

In the course of developing and studying the atomizer test for cleanliness, Linford and Saubestre[1] obtained indications of a correlation between ease of removal by alkaline cleaning and spreading rate of a soil. Such a correlation was developed by Bisio[2] for soils, liquid at room temperature, spreading on the same metal as they were to be removed from by alkaline cleaning (see Fig. 1). Bisio noted, however, that this method was limited due to the corrosive action of many soils on the low carbon steel or copper used in this study. It was felt that the results obtained would have greater industrial significance if a similar correlation could be shown to hold for fats and greases which are solid at room temperature.

Unfortunately, such desired correlations present certain technical problems. In order to determine experimentally the spreading rate of a solid, the work must be performed at an elevated temperature. However, at higher temperatures the problem of corrosion becomes acute. Certain metals such as steel and copper are highly susceptible to attack at even moderate temperatures by fatty acids. Because of this problem, the correlation between the spreading rate of a soil on stainless steel at elevated temperatures and the cleanability of that same soil from low carbon steel was studied. In this way, the corrosion problem during spreading is reduced but the cleaning from steel (the major industrial surface) is still used.

Because of the uncertainty of the possibility of such a correlation, two preliminary studies were made. The first was by using Bisio's data exclusively, to plot the time to reach a cleaning index of 100 on copper vs the spreading slope on steel (see Fig. 2) and also to plot the time

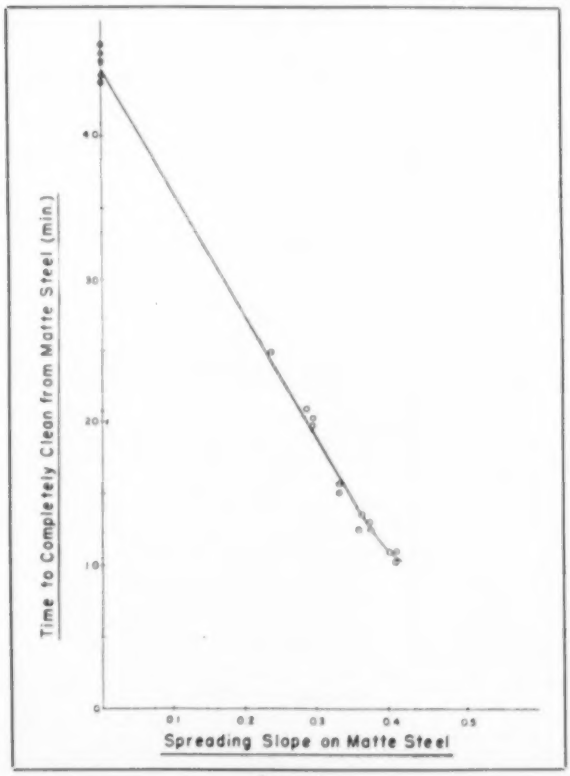

Figure 1
Cleaning on Matte Steel vs Spreading on Matte Steel (Room Temperature)

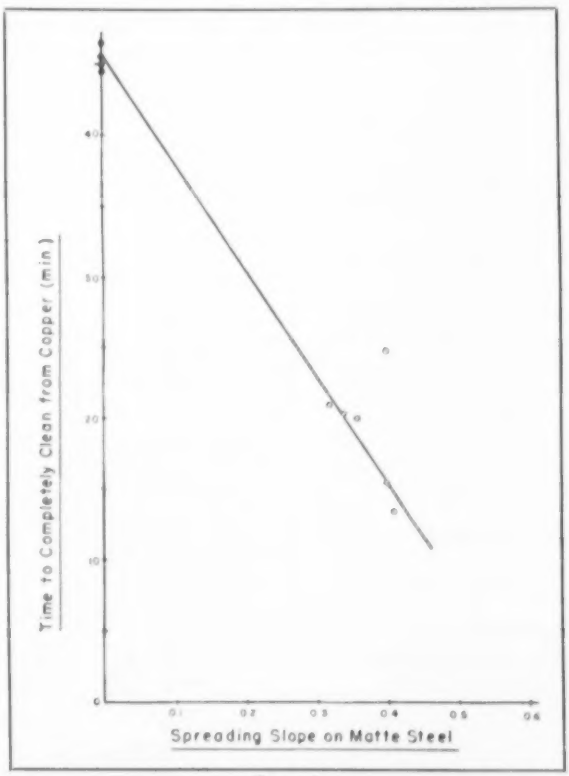

Figure 2
Correlation of Time for C.I. of 100 on Copper vs Spreading Slope on Steel. Experimental data of A. Bisio[2]

†Presented at the 42nd Annual AES Convention, Cleveland, Ohio.

*Professor, Chemical Engineering, Columbia University, N. Y.

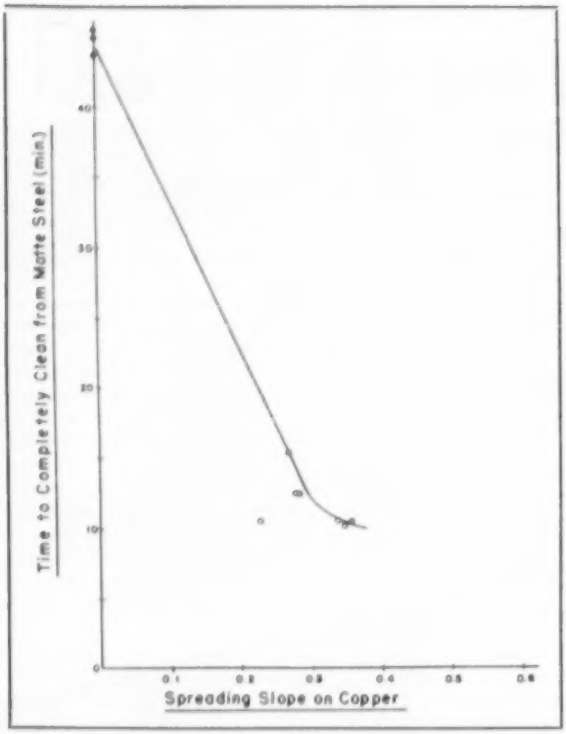

Figure 3
Correlation of Time for C.I. of 100 on Steel vs Spreading Slope on Copper. Experimental data of A. Bisio[2]

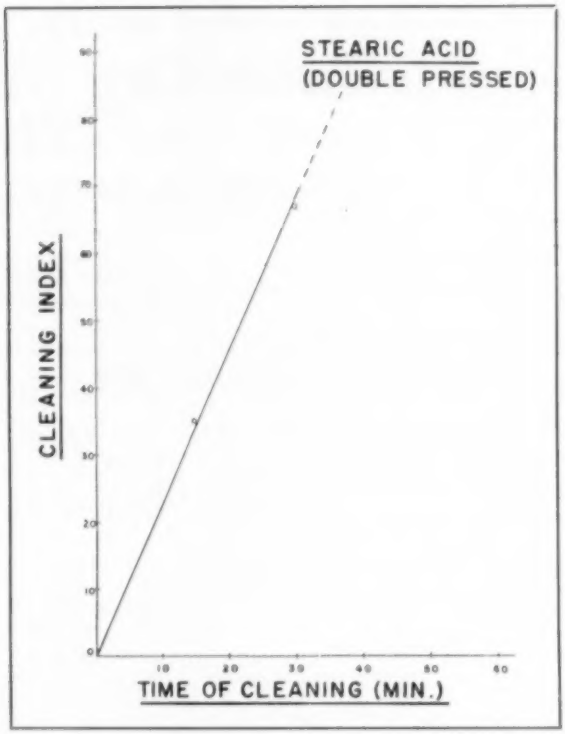

Figure 4-a
Cleaning Index Plot for Stearic Acid (Double Pressed)

TABLE I. SOILING AND CLEANING PROCEDURE[14]

Process	Temperature ° C	Time (min)
Precleaning		
Waste Cleaner	100° C (212° F)	15" soak, 3" overflow
Water Rinse	Room	3" soak, 2" overflow
Pickling		
20 per cent HCl Dip	Room	2
Water Rinse	Room	2
Solvent Treatment		
CH_3OH Dip	Room	2
C_6H_6 Dip	Room	2
Soiling		
Reach Temperature	(176.0 ± 0.9° F) 80.0 ± 0.5° C	10
Soil Dip	(176.0 ± 0.9° F) 80.0 ± 0.5° C	5
Drainage	(176.0 ± 0.9° F) 80.0 ± 0.5° C)	20
Cool in Air	Room	5
Cleaning		
Alkaline Cleaner	100° C (212° F)	Variable soak, 3 overflow
Water Rinse	Room	3 soak, 2 overflow
Testing		
1 per cent HCl Dip	Room	1
Water Rinse	Room	2 overflow
Dry Central Portion	Room	—
Spray and Evaluate	Room	—

to reach a cleaning index of 100 on steel vs the spreading slope on copper (see Fig. 3). The second preliminary investigation was by using Bisio's cleaning data, to correlate that with the spreading rates of the same oils on stainless steel. The spreading rate on stainless steel at 80° C (176° F) of soils, solid at room temperature, was then compared with the time for complete removal of that soil from low carbon steel.

CLEANABILITY

1. Experimental

A. *Soiling and Cleaning Procedure*

The method for determining the cleanability of a soil from a metallic surface has been very thoroughly studied by Linford and Saubestre. The identical method was used by Bisio in his studies. Since the soils studied in this work are solid at room temperature, several modifications of the above mentioned procedure had to be made. In order to reduce the difficulty in comparing results, the standardized procedure was adhered to where possible.

The procedure followed in these cleaning tests is illustrated in Table I. The soiling procedure was the only modification from these tests. The panels were allowed to hang in a constant temperature air-bath for a period of ten minutes in order to reach the preset temperature of 80.0 ±0.5° C (176.0 ± 0.9° F). The oil to be studied had been placed in the bath earlier (generally overnight) in order

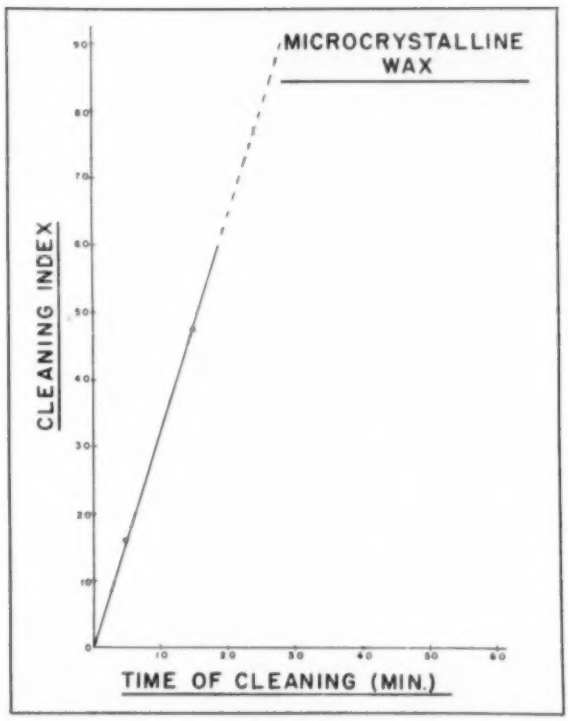

Figure 4-b
Cleaning Index Plot for Microcrystalline Wax

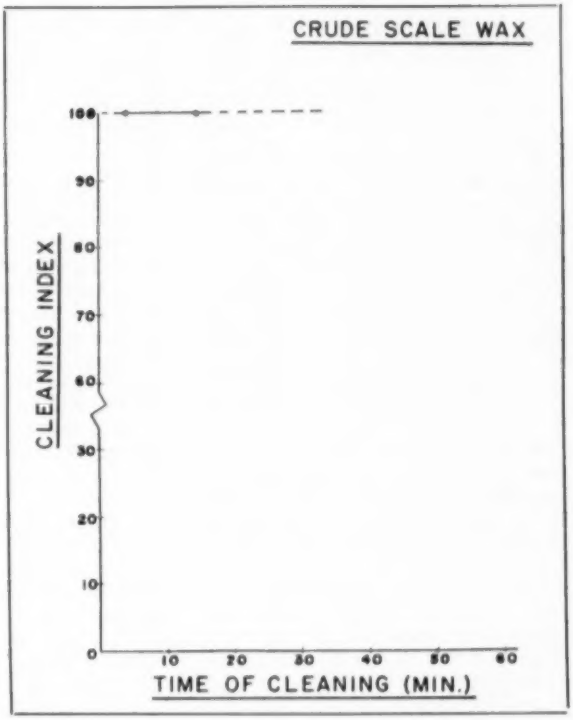

Figure 4-c
Cleaning Index Plot for Crude Scale Wax

to allow it to reach a liquid state and attain the 80 degree temperature. The panels were then allowed to hang in the liquid soil for 5 minutes after which they were removed from the liquid and allowed to drain for 20 minutes, at this temperature. After draining, the panels were allowed to cool in air for a period of 5 minutes before being placed in the cleaning bath.

TABLE II. TIME FOR A C.I. OF 100, SOAK CLEANER

Oil	Time (minutes) on Steel 100° C (212° F)
Microcrystalline Wax (155 Victory Wax)	31.0
Crude Scale Wax (Paraffin)	0
Stearic Acid (Double Pressed)	44.0

TABLE III

Soil	Spreading Slope on Highly Polished Stainless Steel (Passivated), Run at 80° C (176° F)
Crude Scale Wax (Paraffin)	0.51
Hydrofol Acid No. 51	0.00
Hydrofol Glyceride T-57	0.00
Microcrystalline Wax	0.09
Petrolatum (Red Vet)	0.00
Rufat No. 75	0.00
Stearic Acid, Single Pressed	0.00
Stearic Acid, Double Pressed	0.00
Swift Hydrogenated Yellow Glyceride No. 58	0.00
Tall Oil	0.00
Tallow, Soluble Edible Beef Tallow	0.00

Three samples were simultaneously precleaned, soiled and cleaned. The cleaner used was of the following composition, as used by Linford and Saubestre.[14]

Sodium Orthosilicate (Na_4SiO_4)
85 per cent by weight
Sodium Carbonate (Na_2CO_3)
10 per cent by weight
Wetting Agent (Nacconol-NR)
5 per cent by weight
This cleaner was used in a concentration of 45 g/l (6 oz/gal)

B. *Testing*

As outlined by Linford and Saubestre, the atomizer test gives a reproducible method of determining the cleanliness of a metallic surface. This method of testing was closely followed with no exceptions.

C. *Surface Studied*

The cleaning studies were conducted on SAE 1010 matte steel.

D. *Oils Studied*

The following oils* (solid at room temperature) were studied to determine their cleanability:

Micro crystalline Wax (155 Victory Wax)
Stearic Acid (Double Pressed)
Crude Scale Wax (Paraffin)

Included in the Appendix (Table V) are listings of the available physical data of the oils studied.

2. Recording of Results

Each group of three samples soiled, cleaned and tested simultaneously constitutes one run (a point on plot of C.I.† versus time of cleaning) for a particular time of cleaning.

Linford and Saubestre[1] and Bisio[2] showed that for all oil-metal systems studied, a plot of the cleaning index against time of cleaning was a straight line. The plots of the three oils studied are included under Fig. 4. By extrapolation, it is possible to determine the time for cleaning necessary to reach a cleaning index of 100. These determinations are included in Table II. The data are tabulated in Table VIII of the Appendix.

3. Discussion

All three soils were studied under identical conditions in order to study the comparative cleanability of the three. The cleaner and temperature of cleaning were kept the same. The length of times for cleaning were chosen to give as wide a range of points on the cleaning plot as possible. The soiling and draining temperature was fixed at 80° C (176° F) for the reason that at this temperature all the oils studied were liquid. This is the same temperature as used in the spreading rate studies.

Only three oils were included in this test, though many other oils were studied for spreading rates. These three particular oils were chosen, as described further under Discussion of the Correlations, because they were representative of the widest range of spreading rates. As can be observed in Table II, crude scale wax was the easiest to clean, double pressed stearic acid the most difficult, and microcrystalline wax intermediate.

OIL SPREADING RATES

1. Experimental

A. *Temperature Considerations*

Both room temperature and elevated temperature spreading methods were employed in this work. A constant temperature air-bath (see Fig. 5) was constructed in which to conduct both studies. It turned out that the bath was also suitable for the soiling and drainage of the oils in the cleanability tests.

B. *Spreading Surface*

The metallic spreading surface used for spreading rates in this work was stainless steel, type 316, U.S.S. Gauge 20. The panels were approximately 6¾ x 6¼ inches, the surface was highly polished and smooth.* The panels were cleaned in a phosphate cleaner to a cleaning index of 100, water rinsed, dipped in 20 per cent HCl, water rinsed, and placed in an air-bath to reach temperature. Several runs were made on a passivated surface. Here the panel after cleaning and rinsing was treated in 20 per cent HNO_3 for 30 minutes at 60° C (140° F).

TABLE IV. SPREADING RATE SLOPES
(All at 25° C–77° F)

Soil	Spreading Slope on Polished Stainless (Nonpassivated)	Spreading Slope on Polished Stainless (Passivated)	Spreading Slope on Matte Steel (Bisio)
Armour Neatsfoot Oil	0.23	—	0.36
Armour Neo Fat 8. . .	0.14	—	0.32
Armour Neo Fat 42–06	0.00	0.00	0.00
Armour Neo Fat 140. .	0.00	—	0.00
Armour Neo Fat 265. .	0.00	—	0.00
Butyric Acid.	—	—	0.00
Keystone Cutting Oil.	0.28	0.28	0.42
Lard Oil.	0.00	—	0.34
Mineral Oil.	0.25	—	0.46
Nitrobenzene.	0.00	0.00	0.00
Oleic Acid	0.06	—	0.00
Tide Water SAE 20–20W Motor Oil. . . .	0.17	—	0.41
Tide Water SAE 30 Motor Oil.	0.20	—	0.40
Tide Water SAE 40 Motor Oil.	0.24	—	0.40

C. *Oils Studied*

For room temperature studies, all the oils used by Bisio were spread on stainless steel. This tabulation can be found in Table IV. For the study of solids† the tabulation can be found in Table III.

D. *Spreading Procedure*

The oils to be studied were placed in the air-bath for a time sufficient to allow them to come up to temperature (usually overnight). The spreading panel was placed on a support within the air-bath and at one minute intervals drops of the oils (using varying size droppers) were placed on the surface. After the six drops were laid down, a glass measuring panel was placed directly above the spreading plate and as close as possible to the plate without touching it. The arm-ports were closed and measurements were taken. Lighting was supplied by a pair of fluorescent lighting fixtures.‡ Measurements were taken of each drop when it had spread for 9, 16, 23, 30 and 44 minutes.

E. *Method of Measurement*

The glass measuring panel was a section of ¼ inch plate glass approximately 6¾ x 7¼ inches. The glass was scribed with cross lines, 20 lines to the inch. Then every fifth line was darkened alternately with black india ink and red drawing ink. Using a short focus telescope

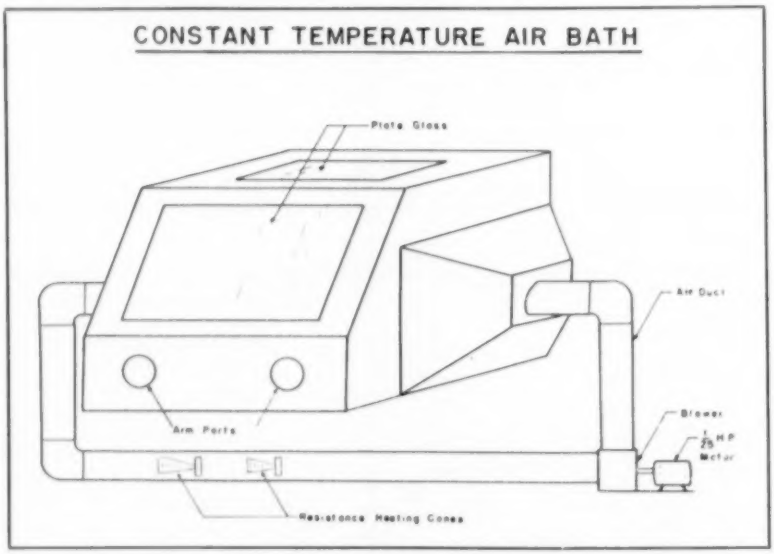

Figure 5
Constant Temperature Air Bath

*These panels were kindly supplied by the Lea Manufacturing Co., Waterbury, Conn.

†These oils were kindly supplied by the Lea Manufacturing Co., Waterbury, Conn.

‡"Lite-Nite," Marblehead, Mass., each fixture 5½ inches long, fitted with 2 standard Sylvania 4 watt cool-white fluorescent bulbs.

placed on the top section of glass of the air-bath, it was possible to note drop sizes on the spreading panel by looking through the measuring plate. The actual drop size was recorded on equivalently marked cross-hatched paper at a magnification of 4 times serving as a permanent record of the spreading drops. It is possible to accurately measure the drop sizes as recorded on the paper with a planimeter.

2. Recording of Results

Linford and Saubestre[1b] showed that at a time equal to 9 minutes there was significant correlation between D_1 (the ratio of the area of the drop at any time to its area 1 minute after application) and initial size. They also found that there was generally no effect of initial drop size on values of D_9 (ratio of the area of the drop at any time to its area 9 minutes after its application) as shown by statistical tests. It was established by Bisio[2] that a plot of D_9 against time on log-log paper generally presents the characteristic form as found by Linford and Saubestre. This work, therefore, concentrated on the area of the drops after the nine-minute period.

The data as found in Tables VI and VII of the Appendix list the average of the separate determination of D_9 at varying times and is listed as $\bar{X}$. The confidence limits (L) referred to in the tables are the limits between which the true value of the mean lies 95 per cent of the time, as determined from the sample.

For each oil-metal system there has been determined the slope of the log-log plot of the oil spreading data. This slope was generally determined for the linear portion of the curve between 9 and 20 minutes. The portion after 20 minutes (if a discontinuity occurs) was arbitrarily neglected in this calculation.

Table III indicates the slopes of the log-log plot of the oil spreading rates of the solids. Because of the large number of plots necessary, Fig. 6 includes only those plots of the several solids which were chosen as representative and of which cleaning data were obtained.

In addition, Table IV indicates the spreading slope of the liquid oils on highly polished stainless steel (passivated and nonpassivated) and compares it with the spreading slope as found by Bisio, spreading on matte steel.

3. Discussion of Results

In order to obtain reliable and reproducible spreading rate data, the panels on which the spreading is performed must be absolutely clean as determined by the atomizer test. In the initial room temperature work a great deal of difficulty occurred in preparing clean panels, the unclean panels giving erratic results. It was finally determined that the cleaning and rinsing method was not at fault; rather it was the post-treatment, the solvent dips. This method had been used because it was desirable to keep the number of variables down, and this was the method employed by Bisio. However, upon further investigation, it was learned that the purpose in using the solvent dips was to dry the panel as rapidly as possible to prevent rust formation on the low carbon steel. Since rust formation is not a problem with stainless steel, these steps were omitted from the procedure. When this was done, clean panels were rather easily obtainable.

When work was performed at the elevated temperatures, the oils to be studied and the panels on which the spreading was going to be performed were placed in the constant temperature air-bath overnight to ensure a steady temperature. After the first run, the panel was removed and the portions untouched by the spreading drops were checked for cleanliness and it was noticed that the panel was not clean. Upon further examination it was concluded that at those elevated temperatures, there was a slight volatilization of the oils, resulting in an oily atmosphere which settled on the cleaned panels. Future work, then, involved the wrapping of the panels after cleaning in aluminum foil before placing them in the bath, thus ensuring clean panels for the future runs.

As noticed in previous work, the initial drop size had no effect upon the spreading slopes of the oils. Thus, no pains were taken to ensure identical drop sizes at the start.

As can be seen in Fig. 6 for the plot of Microcrystalline Wax there was a retraction of the drop size somewhere after 30 minutes. This phenomenon occurred in several other samples, though it is not

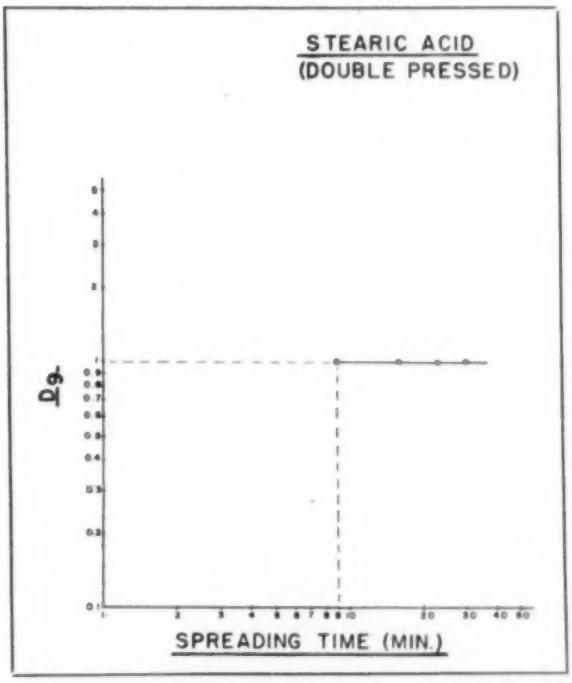

Figure 6-a
Spreading Rate Plot for Stearic Acid (Double Pressed)

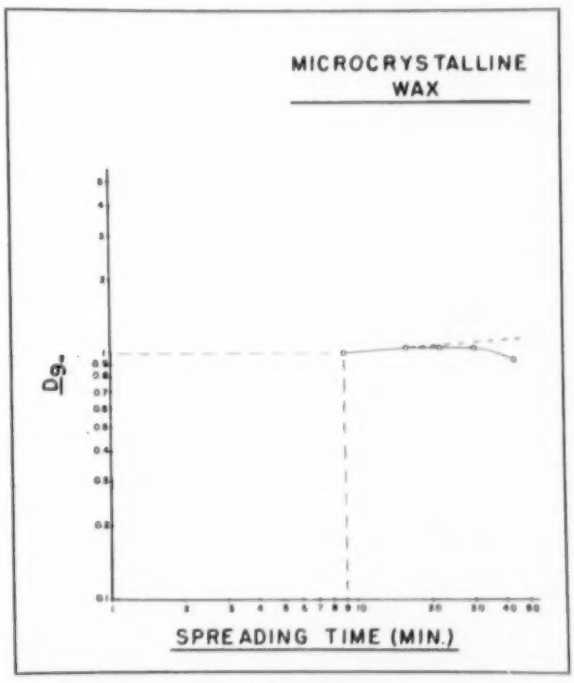

Figure 6-b
Spreading Rate Plot for Microcrystalline Wax

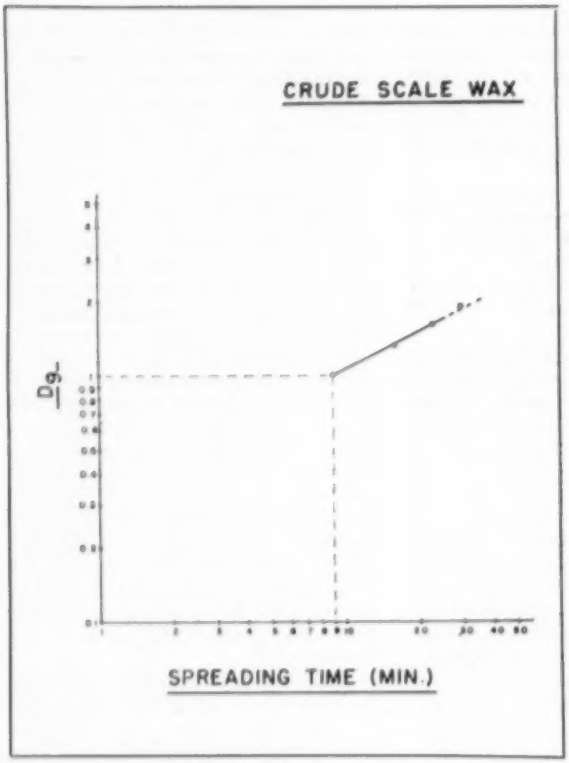

Figure 6-c
Spreading Rate Plot for Crude Scale Wax

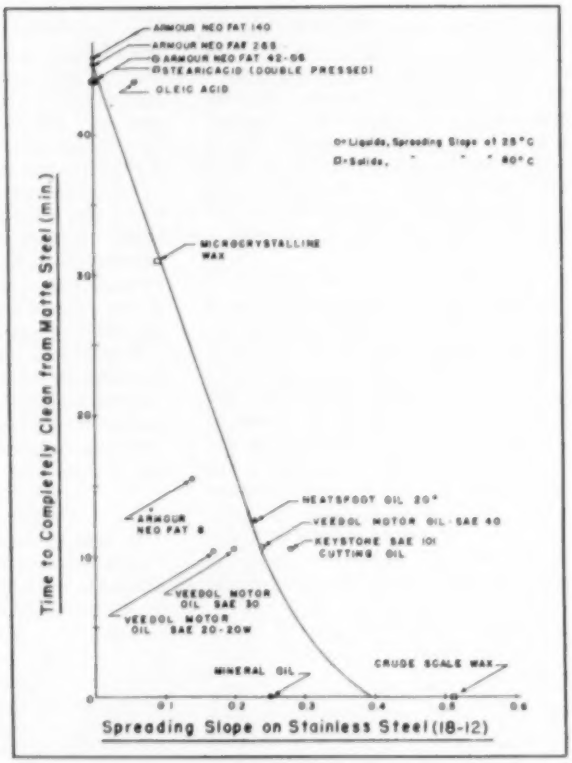
ARMOUR NEO FAT 140
ARMOUR NEO FAT 265
ARMOUR NEO FAT 42-56
STEARIC ACID (DOUBLE PRESSED)
OLEIC ACID
O=Liquids, Spreading Slope at 25°C
D=Solids, " " " 80°C
MICROCRYSTALLINE WAX
HEATSPOOT OIL 20°
VEEDOL MOTOR OIL-SAE 40
KEYSTONE SAE 10t CUTTING OIL
ARMOUR NEO FAT 8
VEEDOL MOTOR OIL SAE 30
VEEDOL MOTOR OIL SAE 20-20W
MINERAL OIL
CRUDE SCALE WAX
Time to Completely Clean from Matte Steel (min.)
Spreading Slope on Stainless Steel (18-12)

Figure 7
Correlation: Cleaning on Steel vs Spreading on Stainless Steel for Room Temperatures and Elevated Temperatures

serious since the slope is determined for the portion from 9 to 20 minutes. This retraction can be attributed to evaporation of the oil.

Upon examination of the raw data of the spreading rates of the oils, several cases were noticed where the particular oil stopped spreading. For spreading on matte steel, this initial spreading was attributed to the result of instantaneous formation of soluble corrosion products, the rapidity of the corrosion soon stifles the spreading by erecting a barrier to the oil. Since this spreading was done on a noncorrosible material, no explanation is offered.

As reported by Linford and Saubestre, the spreading of oils on solids is characterized by noting that those materials which possess a high dipole moment spread only slightly, if at all. Conversely, a symmetrical material could be expected to spread rapidly. Polar organic molecules form oriented monolayers. The polar group (probably the nonorganic end) adsorbing in the metallic surface, the oleophobic methyl group end exposed at the surface. This polar material, then, forms a lens and does not spread. A nonpolar material is affected only by van der Waal's and unsaturated metal surface forces and thus is more likely to spread rapidly. Other factors besides physical adsorption also affect the spreading rate of an oil on a solid. Chemical reactivity of the metal with the oil must be considered as well as the production of soluble corrosion products, such a situation accelerating spreading. By capillary action and by an increase in the hysteresis of the contact angle, surface roughness tends to also increase the spreading rate. This can be observed by noting the results tabulated in Table IV. In all cases except one, the spreading rate of a particular oil was less on highly polished stainless steel than on the rougher matte steel. The one exception is Oleic Acid which did spread very slightly on the stainless, and reported not spreading on the matte steel; however, since the spreading was very slight, it is felt to be within experimental error and not necessarily an exception.

Though all the room temperature runs were made on nonpassivated surfaces, it was felt that it was important to determine if there would be any change for a passivated surface. Thus, several of the oils were spread on a passivated surface and their spreading rates noted. Table IV indicates those results and shows that there appeared to be no discrepancy between the two surfaces. All the solid spreading rate determinations were made on a passivated surface.

4. Correlation of Cleanability with Oil Spreading

A. *Discussion for Liquids, Cleaning on Steel vs Spreading on Stainless Steel (Room Temperature)*

As reported earlier, room temperature spreading rates were determined for the identical oils used by Bisio, only this time spreading on stainless steel. Figure 1 is a reproduction of the correlation obtained by Bisio. Figure 7 is a plot using Bisio's data for cleaning time, and the new experimental data for spreading rate. As can be observed (the two plots are to the same scale) the correlation is very similar. When this plot was determined, work immediately turned to the study of solids.

B. *Discussion for Solids, Cleaning on Steel vs Spreading on Stainless Steel (Elevated Temperature)*

Figure 7 also includes the several points representing the new cleaning data and spreading rate data for the solids. The spreading rate tests were made first and on the eleven oils studied, only two spread at all. Arbitrarily choosing Stearic Acid, Double Pressed as representative of the nonspreaders, and using the two spreaders, cleaning tests were made on these three. The correlation plot, therefore, indicates that again, the same similar type correlation exists for these solids. Since this work was really exploratory in nature, more oils should be studied to more accurately determine the existing correlation. Nevertheless, the three points obtained indicate that some correlation does exist.

*Contribution from the Chemical Engineering Laboratories, Engineer Center, Columbia University, N. Y.

TABLE V.—PROPERTIES OF OILS

1. *Crude Scale Wax* (Paraffin)
   - Typical Melting Point... 50–52° C (122–126° F)
2. *Hydrofol Acid No. 51* (Hydrogenated Fish Fatty Acid)
   - Acid No. ... 197–202
   - Sap Value ... 198–203
   - Iodine Value ... 6 max
   - Titre ... 51–53° C (124–127° F)
   - Chain Length—Acids
     - C_{14} ... 7.5 per cent
     - C_{16} ... 33.3 per cent
     - C_{18} ... 27.2 per cent
     - C_{20} ... 17.2 per cent
     - C_{22} ... 14.8 per cent
     - Unsaturated ... 4.3 per cent
     - Saturated ... 95.7 per cent
3. *Hydrofol Glyceride T-57* (Hydrogenated Fish)
   - FFA Max as Oleic ... 0.25
   - Acid No. ... 0.5
   - Sap Value ... 193–196
   - Iodine Value ... 1 max
   - Titre ... 59–62° C (138–144° F)
   - Melting Point ... 61–65° C (142–149° F)
   - Chain Length—Acids
     - C_{14} ... 0.2 per cent
     - C_{16} ... 24.6 per cent
     - C_{18} ... 75.2 per cent
     - Unsaturated ... 1.0 per cent
     - Saturated ... 99.0 per cent
4. *Microcrystalline Wax* (155 Victory Wax)
   - Melting Point ... 68–82° C (155–180° F)
5. *Petrolatum* (Red Vet)
   - Melting Point ... 49–71° C (120–160° F)
   - Dielectric Constant ... 2.2
6. *Rufat No. 75*—Hydrogenated Tallow Fatty Acid
   - Titre ... 56–60° C (133–140° F)
   - Iodine Value ... 10 max
   - Free F.A. ... 96–99
   - Acid Value ... 191–197
   - Sap Value ... 198–200
7. *Stearic Acid—Single Pressed*
   - Titre ... 53–54° C (127–129° F)
   - Iodine Value ... 9–12
   - Free F.A. ... 103–105
   - Acid Value ... 205–209
   - Sap Value ... 206–210
   - Approximate Composition
     - Myristic ... 1.0 per cent
     - Palmitic ... 47.0 per cent
     - Stearic ... 40.0 per cent
     - Oleic ... 8.0 per cent
     - Linoleic ... 2.0 per cent
8. *Stearic Acid—Double Pressed*
   - Titre ... 54.1–54.5° C (129.5–130° F)
   - Iodine Value ... 7.0 max
   - Free F.A. ... 103–105
   - Acid Value ... 205–209
   - Sap Value ... 206–210
   - Approximate Composition
     - Myristic ... 1.0 per cent
     - Palmitic ... 51.0 per cent
     - Stearic ... 42.0 per cent
     - Oleic ... 6.0 per cent
9. *Swift Hydrogenated Tallow Glyceride No. 58*
   - Titre ... 42–62° C (108–144° F)
10. *Tall Oil*

	Min-Max Value
Acid Number	107–174
Saponification Number	142–185
Iodine Number	135–216
Per Cent Fatty Acids	18–60

11. *Tallow* (S. Edible Beef Tallow)
    - Titre ... 36–40° C (97–104° F)
    - Iodine Value ... 65–75
    - Free F.A. ... 97–99
    - Acid Value ... 193–197
    - Sap Value ... 194–198
    - Approximate Composition
      - Myristic ... 3.0 per cent
      - Palmitic ... 24.0 per cent
      - Stearic ... 15.0 per cent
      - Oleic ... 50.0 per cent
      - Linoleic ... 4.0 per cent
      - Linolenic ... 1.0 per cent

TABLE VI. SPREADING RATE DATA OF SOILS (LIQUID AT ROOM TEMPERATURE) ON 18-12 STAINLESS STEEL, EITHER PASSIVATED OR NONPASSIVATED AS DESCRIBED UNDER "SPREADING RATES" SECTION 1, B

All Spreading Runs made at 25.0 ± 0.1° C (77.0 ± 0.18° F), Except as Indicated

Time (min)	Armour Neatsfoot Oil, 20° (nonpassivated S.S.)		Armour Neo-Fat 8 (nonpassivated S.S.)		Armour Neo-Fat 42-06 (nonpassivated S.S.)		Armour Neo-Fat 42-06 (passivated S.S.)	
	$\bar{X}$	± L	$\bar{X}$	± L	$\bar{X}$	± L	$\bar{X}$	± L
9	1.00	0	1.00	0	1.00	0	1.00	0
16	1.13	0.10	1.08	0.04	1.00	0	1.00	0
23	1.25	0.16	1.13	0.08	1.00	0	1.00	0
30	1.31	0.23	1.13	0.08	1.00	0	1.00	0
44	1.51	0.38	1.13	0.08	1.00	0	1.00	0

Time (min)	Armour Neo-Fat 140 (nonpassivated S.S.)		Armour Neo-Fat 265* (nonpassivated S.S.)		Butyric Acid (nonpassivated S.S.)		Keystone SAE 101 Cutting Oil (nonpassivated S.S.)	
	$\bar{X}$	± L	$\bar{X}$	± L	$\bar{X}$	± L	$\bar{X}$	± L
9	1.00	0	1.00	0	Drops all spread very rapidly, but before 9 minutes, had spread off the panel; all evaporated shortly after.		1.00	0
16	1.00	0	1.00	0			1.17	0.03
23	1.00	0	1.00	0			1.29	0.02
30	1.00	0	1.00	0			1.42	0.03
44	1.00	0	1.00	0			1.60	0.13

*Spread at 35.0 ± 0.2° C (95.0 ± 0.36° F).

Time (min)	Keystone SAE 101 Cutting Oil (passivated S.S.)		Lard Oil (nonpassivated S.S.)		Mineral Oil (nonpassivated S.S.)		Nitrobenzene (nonpassivated S.S.)		Nitrobenzene (passivated S.S.)	
	$\bar{X}$	± L	$\bar{X}$	± L	$\bar{X}$	± L	$\bar{X}$	± L	$\bar{X}$	± L
9	1.00	0	1.00	0	1.00	0	1.00	0	1.00	0
16	1.18	0.03	1.00	0	1.15	0.06	1.00	0	1.00	0
23	1.30	0.04	1.00	0	1.26	0.09	1.00	0	1.00	0
30	1.40	0.09	1.00	0	1.34	0.16	1.00	0	1.00	0
44	1.58	0.17	1.00	0	1.51	0.37	1.00	0	1.00	0

Time (min)	Oleic Acid (passivated S.S.)		Tide Water SAE 20-20W Motor Oil (nonpassivated S.S.)		Tide Water SAE 30 Motor Oil (nonpassivated S.S.)		Tide Water SAE 40 Motor Oil (nonpassivated S.S.)	
	$\bar{X}$	± L	$\bar{X}$	± L	$\bar{X}$	± L	$\bar{X}$	± L
9	1.00	0	1.00	0	1.00	0	1.00	0
16	1.04	0.03	1.09	0.05	1.12	0.05	1.16	0.10
23	1.05	0.04	1.16	0.05	1.20	0.07	1.26	0.12
30	1.05	0.04	1.23	0.06	1.29	0.09	1.35	0.14
44	1.05	0.04	1.31	0.09	1.39	0.13	1.49	0.16

TABLE VII. SPREADING RATE DATA OF SOILS (SOLID AT ROOM TEMPERATURE) ON 18-12 STAINLESS STEEL, PASSIVATED AS DESCRIBED UNDER "SPREADING RATES", SECTION 1, B

Temperature is indicated in Table

Time (min)	(Crude Scale Wax) (Paraffin) 80.0 ± 0.5° C		Hydrofol Acid No. 51 (Hydrogenated Fish Fatty Acid) 75.0 ± 0.5° C		Hydrofol Glyceride T-57 (Hydrogenated Fish) 75.0 ± 0.5° C		Microcrystalline Wax (155 Victory Wax) 80.0 ± 0.5° C		Petrolatum (Red Vet) 75.0 ± 0.5° C	
	$\bar{X}$	± L	$\bar{X}$	± L	$\bar{X}$	± L	$\bar{X}$	± L	$\bar{X}$	± L
9	1.00	0	1.00	0	1.00	0	1.00	0.01	1.00	0
16	1.34	0.06	1.00	0	1.00	0	1.06	0.01	1.00	0
23	1.61	0.14	1.00	0	1.00	0	1.06	0.01	1.00	0
30	1.92	0.28	1.00	0	1.00	0	1.06	0.02	1.00	0
44	2.13	0.84	1.00	0	1.00	0	0.97	0.13	1.00	0

Time (min)	Rufat No. 75, Hydrogenated Tallow Fatty Acid 75.0 ± 0.5° C		Stearic Acid Single Pressed 80.0 ± 0.5° C		Stearic Acid Double Pressed 80.0 ± 0.5° C		Swift Hydrogenated Tallow Glyceride No. 58 75.0 ± 0.5° C		Tall Oil 75.0 ± 0.5° C		Tallow, Soluble Edible Beef Tallow 75.0 ± 0.5° C	
	$\bar{X}$	± L	$\bar{X}$	± L	$\bar{X}$	± L	$\bar{X}$	± L	$\bar{X}$	± L	$\bar{X}$	± L
9	1.00	0	1.00	0	1.00	0	1.00	0	1.00	0	1.00	0
16	1.00	0	1.00	0	1.00	0	1.00	0	1.00	0	1.00	0
23	1.00	0	1.00	0	1.00	0	1.00	0	1.00	0	1.00	0
30	1.00	0	1.00	0	1.00	0	1.00	0	1.00	0	1.00	0
44	1.00	0	1.00	0			1.00	0	1.00	0	1.00	0

TABLE VIII. CLEANING DATA

All soils tested in a silicate cleaner (as described under "Cleanability," Section 1, A) at a temperature of 100° C (212° F)

Soil	Time (min)	C.I.
Crude Scale Wax (Paraffin)	4	100.0
	20	100.0
Microcrystalline Wax (155 Victory Wax)	5	16.0
	15	47.5
Stearic Acid, Double Pressed	15	35.0
	30	67.0

LITERARY REFERENCES

[1](a) H. B. Linford and E. B. Saubestre, Plating **37**, 1265–1269 (1950)
(b) Ibid., **38**, 60–65 (1951)
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DR. HENRY B. LINFORD

Linford

Dr. Henry B. Linford was born April 23, 1911 in Logan, Utah. He earned his B.S. degree from Utah State Agricultural College in 1931; M.S. and Ph.D. from State College of Washington from 1931–1936 and attended Columbia University from 1936–1937. Dr. Linford has been Professor of Chemical Engineering at Columbia University since 1952.

He is a member of the ACS, Electrochemical Society (Secretary in 1949), NACE, AICE, AES (Director of Research Project No. 12 since 1949). Also, he is a member of the Sigma Xi, Phi Kappa Phi, Phi Lambda Upsilon, Alpha Chi Sigma, Epsilon Chi, and Pi Kappa Alpha.

Mr. Grubbs biography and picture were unavailable.

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The Five Per Cent Salt Spray and Its Acetic Acid Modification

By Wardley D. McMaster*

SYNOPSIS

The plating industry has never had a reliable accelerated test for some of its major items, such as chromium plating, cadmium plating and certain treatments for aluminum. This situation has led to a most unfortunate and widespread weakness of exterior decorative parts. The acetic acid salt spray is a practical means of evaluating plating quality, and should be used to restore the quality of the product to a satisfactory level.

For many years, the plating industry depended upon casual observation of parts in service, to determine whether or not their production standards were acceptable. With the more widespread use of the salt spray in the '20's and '30's, reliance was increasingly placed on it as a method of quality evaluation. We are not aware that any real correlation was developed between service experience and such tests, and believe that the tests were accepted more because severe failures did not develop in them, than because they reflected true quality. Certainly that is the case during the past ten years. It was definitely recognized by some that the usual specifications of 24 to 72 hours with only minor pinholes where rust occurred would serve to reject plates with gross porosity, but that the test bore no relation to the rust-free service life of a part. Later, there was an apparent tendency on the part of all concerned to assume that items that met these specifications would be satisfactory in service. Research and development programs were based on this premise, and finally led the industry into a veritable cul-de-sac, the end of which was reached in the winter of 1953–1954 when much of the automotive industry's "bright work" exchanged its brightness for red rust in its first 30 days of service. Unquestionably, nickel shortages played a part in the tragedy.

For example, bumper guards purchased by one car manufacturer had a plating thickness of 1.5 mils, stood an average of 1000 hours of neutral salt spray, yet failed in four weeks of service in Detroit, and in 16 hours in the acetic acid salt spray. Some form of the salt spray has been in use for 40 years. Its empirical nature tended to discourage exhaustive studies until recently, and further work is indicated to improve the method of control as well as design of cabinets.

A study of the literature[1] indicates considerable difference of opinion as to the most suitable salt concentration, manner of locating test specimens, humidity and humidity control, dimensions of apparatus, nozzle design, and suitability for various purposes. Following the adoption of the method ASTM B117-44T, which established 20 per cent as the concentration of the salt solution, such disagreement arose between buyer and seller that a General Motors Committee was established to study ways and means of overcoming the difficulty. After several years of work, it was determined that while a 20 per cent concentration *could* be made to work well, the same results in substantially the same time, could be more surely obtained by arbitrarily setting the concentration at 5 per cent. This concentration does not require the exacting supervision of the 20 per cent solution; its higher humidity is advantageous in the testing of organic coatings; and there is a distinct saving of labor and material in making the salt solution. For similar reasons, a collection rate of 1–2 ml/hour is preferable to the established ASTM 117–49T rate of 0.5 to 3.0 ml/hour.

The claim of the 5 per cent neutral salt spray were noted by ASTM in 1951, and accepted in place of the 20 per cent salt spray in 1954. During this period, the author and members of the General Motors Accelerated Weathering Subcommittee, and of ASTM B-3 Sub III, had been studying the acetic acid modification of the salt spray proposed by C. F. Nixon,[2] and adopted, but not used, by the General Motors Corporation. Interest in such a method arose because of the failure of the normal salt spray to duplicate the blisters found on plated zinc base die castings in service. Failure to use the method was apparently due to its limited application and the necessity of duplicating salt spray equipment in order to run both the neutral and the acid sprays.

It was at this point that the author became interested in developing a more widespread application of the acid salt spray, and was shortly thereafter requested to form a task group to undertake an exhaustive study of the subject on behalf of ASTM.

The Nixon method called for the use of a 20 per cent salt solution plus up to 1 per cent of glacial acetic acid as required to give a *p*H of 3.2. The temperature used was 120° F. The group's studies showed that this was a valid method, but that it was equally effective if the salt concentration were reduced to 5 per cent and the temperature to 95° F to

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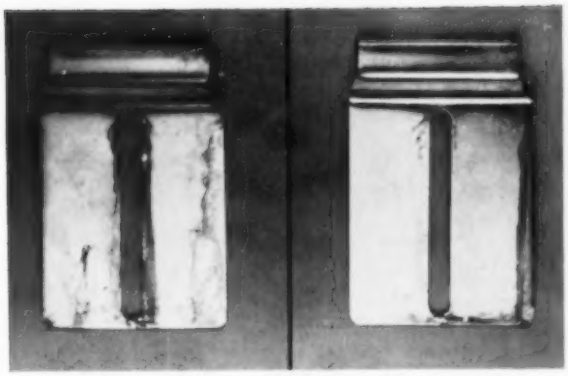

Fig. 1

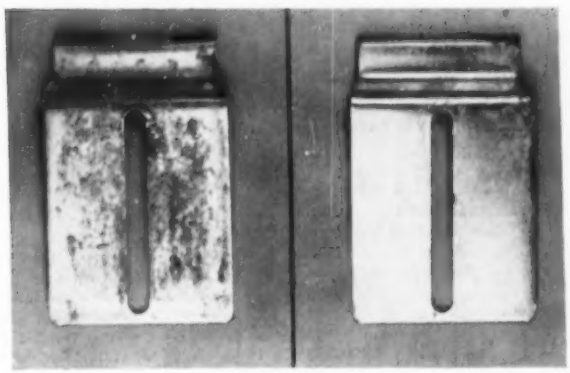

Fig. 2

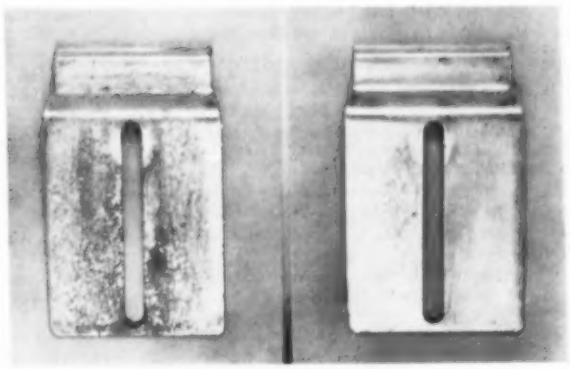

Fig. 3

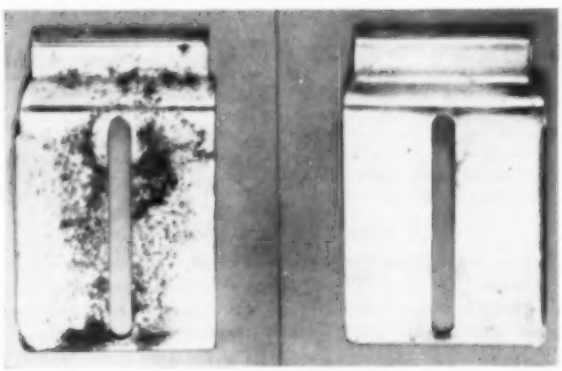

Fig. 4

agree with the operating conditions of the normal salt spray. A slightly longer exposure was required at the lower temperature. It was interesting to find that at either operating temperature the 5 per cent solution was somewhat slower in developing the typical blister than was the 20 per cent solution. This difference is in agreement with the findings of May and Alexander[3] when they compared the corrosion of zinc in 3 per cent and 20 per cent salt sprays. However, this is only one application of the test, and the possible universal application of the procedure is of greater importance than this time element.

Naturally, the first step in the development of a more widespread application of the method, was the testing of copper-nickel-chromium plating on steel in the 5 per cent neutral and the 5 per cent acid salt sprays. Figures 1 and 2 illustrate the results. The "standard" plating has a total thickness of 0.001 inch. Rust originating at the cut edges of this production part is to be ignored. In Fig. 1 the inferior plating shows more rust at the edges but there is no significant difference otherwise, after 500 hours in 5 per cent neutral salt spray. This plating obviously more than meets the current specification "no more than minor pinholes after 32 hours salt spray." After only 240 hours in the acetic acid salt spray, as shown in Fig. 2, the half standard plating shows significant failure, representative of a service failure. The committee exposed identical plates on the roof for one winter, and on the front bumpers of cars for the same winter period, in each case securing results that match those obtained in the acetic acid salt spray, as shown in Figs. 3 and 4. This work was checked with similar panels prepared by several different sources, with the same results.

It is well known that cadmium plating beyond 0.2 mil in thickness does not suffer deterioration at a significant rate in the normal salt spray. This is in accord with experience in a sea-air environment. In the acetic acid salt spray, cadmium of all practical thicknesses fails more rapidly than does zinc of the same thickness (Table I) which is in accord with experience in the industrial-air atmospheres. The automotive industry long ago replaced cadmium with zinc on exposed parts.

TABLE I. COMPARISON OF ZINC AND CADMIUM PLATED STEEL IN THE ACETIC ACID SALT SPRAY AT 95° F

Plate Thickness, mil	Hours to Failure	
	Zinc*	Cadmium
0.15	10	8
0.30	24	16†
0.50	48	24†

The author and many of his associates have reached the conclusion that corrosion of plated parts on automobiles is due more to the acidic industrial atmospheres found in cities than to the salt used on streets to melt snow, although the latter is a factor. For instance, a light fall of snow has been found to have a *p*H as low as 3.5, and to have produced all the usual evidences of service corrosion on new cars standing in dealers' lots. It is recognized that the active agent

*Approximately 50 per cent faster than plain salt spray.
†These plates do not fail in plain salt spray.

may be a solution of oxides of sulfur, but the use of acetic acid is preferable for test purposes.

Tests were extended to cover aluminum, aluminum alloys, anodized aluminum, phosphated aluminum, aluminum coated steel, stainless steels, nickel plate on steel, various paint coatings on steel, phosphated and painted steel, and rust inhibiting oils and compounds on steel. It appears that any material that may be tested in the normal salt spray may also be tested in the acetic acid salt spray, and that similar end results will be obtained, usually in a shorter time.

It is therefore recommended that all suppliers and users of plated ware adopt the acetic acid salt spray for qualifying their product,[4] and that they develop their specifications to produce the desired quality. Table II is intended to suggest the number of hours in 5 per cent acetic acid (*p*H 3.2) salt spray at 95° F and at 120° F that will be required to assure a blister-free life of 1 year, in Detroit outdoors exposure on a motor car, for plated zinc base die castings.

TABLE II. PLATED ZINC BASE DIE CASTINGS IN ACETIC ACID SALT SPRAY

Film Thickness	Standard 1.485	Substandard 0.655
Copper	0.35	0.20
Nickel	1.13	0.45
Chromium	0.005	0.005
Hours to Failure by Blistering		
95° F	60	30
120° F	35	16

Table III is intended to indicate the number of hours in the acetic acid salt spray at 95° F without rust development to assure one year's service without failure, on an automobile used on the streets of Detroit, and the hours expected of other thicknesses of plate of comparable quality. Varying thicknesses of plate will be specified according to the service life required.

TABLE III. CHROME PLATING IN THE ACETIC ACID SALT SPRAY

Film Thickness of Good Quality Plate	Hours to Failure by Scattered Rusting	Estimate of Failure-Free Life on Car, in Winter, Detroit
0.0001 inch	8	1 week
0.0002 inch	16	2 weeks
0.0003 inch	32	4 weeks
0.0005 inch	72	8 weeks
0.001 inch	168	20 weeks
0.0015 inch	240	1 year
0.003 inch	750	3 years

Actual service life and salt spray life are tabulated lower than found in some of our tests, and the values should therefore be regarded as minimums. As previously discussed, thickness without quality is wasteful and unsatisfactory. Many factors are known to affect the quality of plating with copper-nickel-chromium.

1. Thickness
2. Preparation of the base metal surface
3. Buffing of the metal layers
4. Alternation of metallic layers
5. Brighteners
6. Accelerators
7. Temperature
8. Current density
9. Impurities in the bath
10. Bath concentrations

It is recognized that the improvement of plating quality may be a real problem in certain situations, and the results obtained in the acetic acid salt spray test will be disappointing, though valid. It will be necessary to tolerate poor quality until the necessary adjustments can be made. For this reason the normal requirements are not being rushed into the form of final specifications. At the same time it is to be noted that the requirements shown in the tabulation have been met in production and therefore can again be met.

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WARDLEY D. McMASTER

Wardley D. McMaster, Assistant Head, Chemistry Department, Research Laboratories Division, General Motors Corporation, Detroit, has been in charge of the testing of organic coatings, metal treatments, and plating, since 1929. He is chairman of the Corporation's Accelerated Testing Committee, and of the Task Force of ASTM B-3, Sub III assigned to this study.

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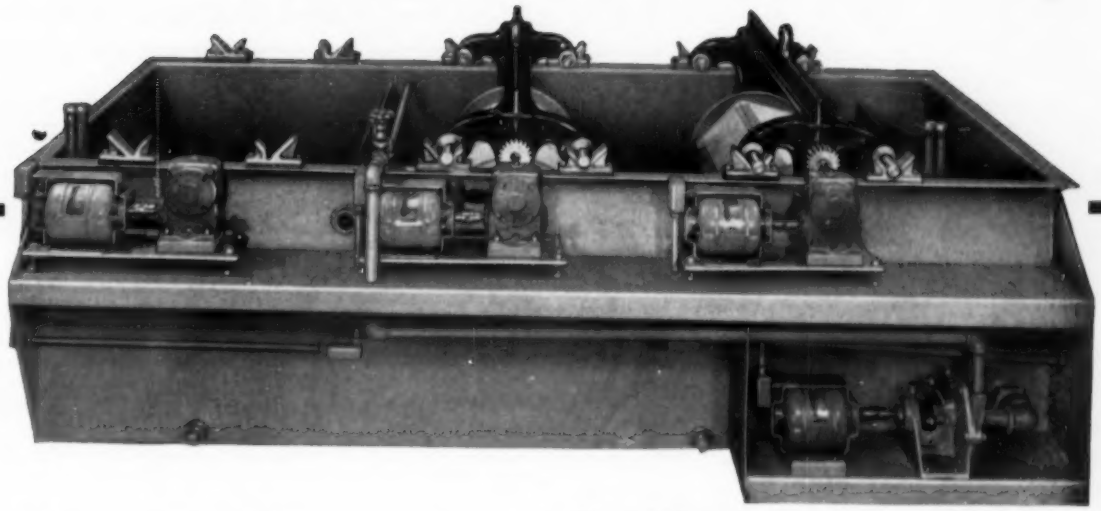

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Tin and Its Uses, April 1955, p. 11

62. ALUMINUM AND MAGNESIUM FINISHES
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b. *BRIGHT-DIP LINE FOR ALUMINUM OR BRASS*
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c. *HOW HAE IS DOING*
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a. *HARDWARE PLATING—AUTOMATION TAKES OVER*
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d. *BLAST CLEANING PROVIDES BETTER SURFACE*
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68. NICKEL
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a. *SPOTTING-OUT AND STAINING ON PLATED WORK*
G. B. Hogaboom, Jr.
Metal Finishing, May 1955, p. 54

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a. *SALT SPRAY PASSES ACID TEST*
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R. H. Rousselot
Metal Finishing, May 1955, p. 50
c. *PLATING BATH CONTROL: PAST, PRESENT AND FUTURE*
J. B. Kushner
Metal Finishing, May 1955, p. 59
d. *CHEMICAL AND ELECTROCHEMICAL ACCOUNTING HELPS CONTROL JOB PLATING PLANT*
E. A. Blount
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No. 2,697,673, Dec. 21, 1954—Method of Cleansing Metal—J. Rice, assignor to Cyrus Wm. Rice & Company, Pittsburgh, Pa.

A method is described for determining the effectiveness of a pickling solution on a metal such as ferrous metals carrying rust of scale by using a millivoltmeter connected between the work and another electrode free of scale and determining the drop in potential with respect to time.

4 claims, 7 figures.

No. 2,697,689, Dec. 21, 1954—Combination Barrel and Rack Electroplating Apparatus—S. Barr and C. I. Knecht, said Barr assignor to Western Electric Co., Inc., New York.

Providing a mechanism for both barrel and rack plating is accomplished by making the barrel and rack units easily removable and interchangeable by providing camming means on the same shaft that drives the barrel, said camming means causing the rack when in position to reciprocate the cathode rods of the rack.

1 claim, 4 figures.

No. 2,697,690, Dec. 21, 1954—Electroplating Rack—A. Beebe, Jr., assignor to Federal Mogul Corp., Detroit, Mich.

A rack for electroplating bearing linings is described. Some of the objectives in the disclosure being:

A rack for which the anode is entirely external.

A rack in which the anode current density may be widely varied.

A rack in which process the anodes may be bagged or separated from the bearings by means of a porous diaphragm.

4 claims, figure 6.

No. 2,698,258, Dec. 28, 1954—Method of Coating a Reflective Metal Surface—L. McGraw and C. Faust, assignors to Ohio Plate Glass Co., Toledo, Ohio.

A method of protecting metal reflective surfaces, e.g. silver mirrors, consists of depositing a metal hydroxide on the (on glass, etc.) metal by immersion in an aqueous solution (zinc, lead, tin, aluminum or thalium oxides in alkali), aged 1–3 weeks and diluted from about 225 grams metallic compound to 1/5–1/20th, followed by baking to form the oxide of the metal. A copending application covers organic coatings over the oxide protective film.

5 claims, 2 figures.

No. 2,698,262, Dec. 28, 1954—Method of Sealing Anodized Aluminum—F. Balmas, Versailles, France.

The use of chlorinated diphenyl to seal aluminum is accomplished by dissolving pentachlorodiphenyl in a suitable solvent, with or without 0.2–2.0 per cent chlorinated paraffin, and immersing the anodized article therein, after which the treated anodize aluminum is heated to 100–120°C.

7 claims.

No. 2,298,266, Dec. 28, 1954—Material for Treating Metal Surfaces to Improve Corrosion Resistance and Paint Bonding Ability—J. Thrisk, assignor to American Chemical Paint Company, Ambler, Pennsylvania.

The aqueous metal treating bath consists of chromic acid (0.04–12 g/l) and cerium nitrate (0.02–6 g/l). The disclosure refers particularly to aluminum conversion coatings formed by Formula IV, for example:

Sodium fluoride	5 g/l
Chromic acid	10 g/l
Arsenic acid	92.5 g/l

The treated metal is then dipped in the solution which is the subject of the patent (Formula V):

Chromic acid	4 g/l
Ceric nitrate	2 g/l

This schedule is claimed to be especially meritorious following the formation of crystalline phosphate coatings.

2 claims.

No. 2,698,302, Dec. 28, 1954—Detergent Compositions Containing Metal Discoloration Inhibitors—H. Sylvester, assignor to Colgate-Palmolive Co., Jersey City.

The tarnishing of copper-base alloys by detergents, especially those containing polyphosphates may be inhibited by incorporating thiourea derivatives in the detergent composition. Monophenyl, monotolyl and ditolyl thiourea mentioned. The unsymmetrical mononuclear aryl thiourea content should be 0.05–3 per cent by weight.

10 claims.

No. 2,698,781—Accelerating Action of Acids on Metal—W. Meyer, assignor to Enthone, Inc., New Haven, Conn., January 4, 1955.

Metals above hydrogen in the e.m.f. series may be dissolved in an aqueous strong acid solution containing a nitro-aromatic compound providing a potential greater than −0.9 volt using a sheet nickel electrode vs. a saturated calomel electrode at 80° C, pH of 8 to 13 and a NaCN concentration of 2M with 0.25 gram mol of the nitro-compound present. Example 2 describes a 1 per cent sulfuric acid solution containing 10 g/l of the sodium salt of meta nitrobenzene sulfonate to provide 23 atoms of acid hydrogen per atom of nitro oxygen for stripping nickel plated copper.

18 claims.

No. 2,698,810—Coating Process—R. Stauffer, assignor to National Research Corp., Middlesex County, Mass., January 4, 1955.

This invention relates to the coating of uniform thin layers of group VIa metals by contacting the surface of the material to be coated with a mixture of powdered inert material (e.g. alumina) and solid carbonyl (90–30 per cent of the group VIa metal and heating to 130 to 180° C.

3 claims, 2 figures.

No. 2,698,811—Articles and Process for Fabricating—H. Legg, assignor to Kaiser Aluminum and Chemical Corp., Oakland, Calif., January 4, 1955.

A method of aluminizing is described wherein it is possible to hot-dip a ferrous metal with aluminum by first coating the clean metal with a hydrocarbon wax (m.p., 100°–180° F, F. P. 475°–525° F) of mineral origin adapted to burn at the melting temperature of the coating, then immersing the wax-coated ferrous metal in the molten aluminum or alloy thereof at which time the wax will burn off providing a reducing atmosphere and prevent oxidation of the iron.

4 claims.

No. 2,698,832—Plating Apparatus—H. Swanson, assignor to Standard Process Corp., Chicago, Ill., January 4, 1955.

A novel electroplating apparatus is claimed which permits the plating or replating of small areas by providing a pressed seal chamber to fit against the object and carrying an anode. To this chamber is attached two separate receptacles on opposite sides one higher than the other containing the electrolyte at the start. Gravity flow through the plating chamber is thereby effected and when the higher receptacle is depleted means is provided to rotate the apparatus through 180° to again provide electrolyte flow.

3 claims, 8 figures.

AES News

AES Officers—1955-56

Clyde Kelly, President

BORN in Indiana County, Pa., on September 9, 1902. Has educational background that includes several technical extension courses.

Associated with the American Plating Company, 808 Keo Way, Des Moines, Iowa and formerly with Superior Plating Co., Chicago, Ill.

Kelly

Twice president of the Chicago Branch, AES; general chairman of the 1952 National Convention and Exposition at Chicago. Recently honored by the Chicago Electroplaters Institute as "Plating's Man of the Year." Also chairman of the Research Finance Committee and chairman of the Committee on the Broadening of the AES Base.

Samuel Heiman, First Vice-President

BORN in Philadelphia, Pa., on December 18, 1909. Studied at University of Pennsylvania which awarded him a B.S. in Chemical Engineering in 1930 and a Ph.D. degree in Physical Chemistry in 1948.

Heiman

Employed with A. Kenneth Graham and Associates as research engineer and plating consultant for seven years, at Battelle Memorial Institute as research electrochemical engineer, 1942–1943, and since 1943 at Philadelphia Rust Proof Company as chief chemist and technical director. Author of many papers on electroplating subjects.

Officer of the Philadelphia Branch, AES 1945–1953. President, 1949–1951, general chairman of the 1953 National Convention at Philadelphia.

Francis T. Eddy, Second Vice-President

BORN in Pittsfield, Mass., July 2, 1915; received his A.B. degree in chemistry from Brown University in 1937 and attended the Juilliard School of Music, New York, from 1939–1940.

Eddy

Associated with the Chase Brass and Copper Company, Waterbury, Connecticut, 1946–1954 as superintendent of finishing and assistant plant superintendent. Now general manager Technicraft Laboratories, Inc., Thomastown, Connecticut.

Served as president of the Waterbury Branch; chairman of the New England Regional meeting; chairman of the AES Paper Awards Committee and has been an AES member since 1938; was on ASTM B-8 Committee.

Performed meritoriously in World War II in the U. S. Navy as LCT and LST commander and attained grade of lieutenant.

Herberth E. Head, Third Vice-President

BORN in Owensboro, Kentucky, April 28, 1901; graduated from the Saint Francis Academy, Owensboro, Kentucky. Has been associated with the Chrysler Corporation for some time in the Automotive Body Division, and is presently Supervisor of Electroplating and Related Operations. He is a member of ASTM serving on Committee B-8 on electrodeposition; Society of Automotive Engineers; Electrochemical Society; Engineering Society of Detroit; Sea Horse Institute (Corrosion).

Head

He is a past president of the Detroit Branch, AES; has been a Delegate to National Convention for the past fifteen years and has served on the committee handling all industrial finishing expositions.

Ralph A. Schaefer, Past President

BORN near Grafton, Ohio, on August 16, 1913; studied first at the University of Notre Dame, then at Western Reserve University. He received his B.S. degree in 1935, a M.S. degree in 1936 and a Ph.D. degree in physical chemistry in 1941, all from Western Reserve University.

Schaefer

Associated with Cleveland Graphite Bronze Company, Cleveland, Ohio since 1936; was a director of research 1945–1953 and was named vice-president, Clevite-Brush Development Company in 1953.

Served as president of the Cleveland Branch, AES; was member of AES Research Committee 1946-1949; was chairman of the AES Research Project No. 11 and was named research supervisor in 1950; acted as associate editor of PLATING since 1946. Held many offices in the Electrochemical Society; active in the ASTM and many other technical and scientific societies.

AES News

AWARDS

Carl E. Heussner Award

This award is cosponsored by the AES and Glenn Friedt of United Platers, Inc., of Detroit.

The Carl E. Heussner award consists of the AES Gold Medal, $50.00 and an award certificate for the best paper printed in Society publications during the year of 1954. **Ralph F. Muraca,** whose article, **"Determinations of Free Cyanide and Zinc in Zinc Cyanide Solutions,"** which appeared in PLATING magazine September 1954, was the choice.

Muraca

Ralph F. Muraca was born July 27, 1921 in Easton, Pa. He attended Easton Senior High School. In 1943 he received his B.S. degree from Lehigh University in Chemistry. In 1947 he earned his M.S. degree, and in 1950 his Ph.D. from the same university. He is a member of Sigma Xi. In addition to being a member of the Exchange Club and the PTA, he serves on the Board of Control of the former and is President of the latter. "Rafe", as he is known to his intimates, is presently Assistant Professor of Chemistry at Lehigh University in Bethlehem, Pa. He is a member of ACS, Amer. Assoc. Adv. of Science, Amer. Assoc. of University Professors, and has been an active member of the Allentown-Reading Branch, AES, since 1951. The Branch has elected him Delegate to the Convention. Dr. Muraca is a well-known author who has contributed extensively to PLATING magazine in the past. His work has been mostly in research in connection with ORSANCO.

AES Silver Medal

The AES Silver Medal with an award of $25.00 is granted for the second best paper printed in Society publications during 1954. **Vincent P. McConnell** with the paper entitled **"Joint Strength Properties of Tin-Lead Alloy Deposits,"** which appeared in the June 1954 issue, was awarded the AES Silver Medal.

McConnell

Vincent P. McConnell was born July 6, 1916 in Jamesville, New York. After attending Jamesville High School, he earned his B.S. in Chemistry at Syracuse University in 1947. "Mac" served in the infantry and saw service in the ETO for two years. He holds the Purple Heart Combat Infantry Badge and the Presidential Unit Citation. McConnell is employed by the General Electric Company as a Project Engineer (Inorganic Chemistry) at Electronics Park, Syracuse, New York. He has been a member of the Syracuse Branch of the AES since 1947 and has served as President, First and Second Vice-President, and Secretary-Treasurer at the Branch level. Nationally, he has been a Delegate in the years 1948 through 1954.

AES Bronze Medal

The AES Bronze Medal, cosponsored by AES and the Grand Rapids Branch, with an award of $15.00 for the third best paper printed in Society publications has been awarded to **K. G. Compton, R. A. Ehrhardt** and **G. Bittrich** whose article **"Brass Plating"** appeared in December 1954.

Compton

Kenneth G. Compton studied Electrical and Chemical engineering at Washington State College where he also completed graduate work in Physical Chemistry. He was employed as an Electrical Engineer by the Bunker Hill and Sullivan Mining Company in Kellogg, Idaho. Thereafter, he was in research in electrochemistry with Bell Telephone Laboratories in New York and studied electronic devices and corrosion. He is a member of ASTM, Vice-Chairman ASTM Advisory Committee on Corrosion; Chairman, Committee on Corrosion of Nonferrous Metals; Member, NACE, NACE Intersociety Committee on Corrosion; retired Chairman, Management Committee, Gordon Research Conference, AAAS. He is a member of the Newark Branch of the AES.

Ehrhardt

Robert A. Ehrhardt was born August 1908 in West Hoboken, New Jersey. He earned his B.S. degree in Chemical Engineering from Cooper Union in 1930, and received the Dickinson Award upon graduation. "Bob" joined Bell Telephone Laboratories in New York in 1924 and has been with them in various capacities to the present day. Ehrhardt worked in rubber, analytical, corrosion, and electrochemistry, specializing in the latter in all its allied arts and facets. He is a member of the ASTM, and serves on the Committees B-8 and B-12 in that Society. He is also a member of the Electrochemical Society and the Newark Branch of the AES, having served as President of that Branch in 1953. He resides in New Providence, New Jersey. He is married to one of the most distinguished ladies of the AES. Loretta is an important member of the Executive Secretary's Staff at National Headquarters.

AES News

Bittrich

Gustav Bittrich was graduated from Cooper Union where he earned a B.S. degree in Chemical Engineering. He is employed by Bell Telephone Laboratories as an Analytical Chemist. Bittrich has done research in development work in electroplating and is a member of the Newark Branch of the AES where he serves as Librarian. He is married and has two sons.

Robert S. Leather Mechanical Finishing Award

The Robert S. Leather Mechanical Finishing Award of the AES is sponsored by the Lea Manufacturing Company and consists of $50.00 and a certificate for the best paper on the subject of mechanical finishing appearing in the Society publications during 1954. **A. S. Kohler** for the article, **"Some Considerations of Importance in Ball Burnishing,"** which appeared in the September 1954 issue of PLATING magazine, is the committee's choice.

Kohler

Arthur S. Kohler was born in November 1902 in Brooklyn, New York. He attended Erasmus Hall and the Brooklyn Polytechnic Institute where he received his B.S. degree in Chemistry in 1925. He accomplished his M.S. in Chemical Engineering at Columbia University. "Art" is a member of Sigma Xi, ACS and the Newark Branch of the AES. Kohler is employed by the Frederick Gumm Chemical Company as Technical Director.

Chromium Plating Award

The Chromium Plating Award of the AES is sponsored by the Nutmeg Chrome Corporation and consists of $50.00 and a certificate for the best paper on the subject of chromium plating appearing in Society publications in 1954. The article, **"Stress in Chromium Deposits"** by **J. E. Stareck, E. J. Seyb,** and **A. C. Tulumello,** which appeared in the October 1954 issue of PLATING, earned this award.

Stareck

"Jesse" Stareck was born in Petersburg, Mich., in 1905. He attended the University of Kansas and received his M.A. degree in Chemistry in 1930 from the University of Kansas Graduate School; his Ph.D. from the same school in 1934. While working on the thesis for his doctorate, Dr. Stareck discovered the method of color plating later to become known as Electrocolor. In 1933 he was awarded the Roy Cross Research Fellowship to further his studies of color plating. He joined the Research Staff of United Chromium, Inc., in 1935. At Unichrome's Waterbury, Connecticut Labs., he continued his researches and developed a process of electrodepositing patterns, known as Patternplate. For these contributions, Dr. Stareck received the Edward Longstreth Medal from the Franklin Institute in 1939. In 1941 Dr. Stareck moved to the Detroit Research Labs of United Chromium as Director of Research. Dr. Stareck is active in the ACS, the Electrochemical Society, the Electrodepositors' Technical Society, The Engineering Society of Detroit, and the ASTM. He is a member of the Detroit Branch of the AES.

Classified Advertisements

Only "Help Wanted" and "Situations Wanted" will be accepted. Rates: $.20 per word, minimum $5.00. AES branch members and members-at-large, in good standing, are entitled to a total of three *free* advertisements in one year. Last day for inserting advertisements is the 10th of month preceding date of publication. When answering advertisements please address as follows: Box number, PLATING, 445 Broad Street, Newark 2, N. J.

SITUATION WANTED—Foreman Plater—Have ten years progressive job shop experience in various phases of plating, including anodizing. Conscientious and ambitious. Desire position with progressive company in Long Island, N. Y. Salary commensurate with ability. Reply to Box Jy1, PLATING, 445 Broad St., Newark 2, N. J.

SITUATION WANTED—Foreman or superintendent, 20 years experience in production plating, polishing, buffing and spraying. Can also handle sales and installation work. Chicago area. Reply to Box Jy9, PLATING, 445 Broad St., Newark 2, N. J.

SALES REPRESENTATIVE for eastern job plating shop. Experienced in all phases of electroplating and metal finishing on high production. Reply to Box Jy3, PLATING, 445 Broad St., Newark 2, N. J.

POSITION WANTED—As Laboratory Supervisor or Chemical Process Engineer. Age 38; 14 years experience with 3 manufacturing companies, 2 being refrigerator plants. Familiar with all chemical processes and metal finishing. Most recent experience with large, very critical, babbit plating on aluminum operation. Will relocate. Reply to Box Jy4, PLATING, 445 Broad St., Newark 2, N. J.

SITUATION WANTED—Chemist, 36, 11 years diversified inorganic industrial experience includes plating, batteries, and general physical and chemical commercial testing; seeks position in New Jersey, eastern Penna., southeastern New York, and environs. Reply to Box Jy7, PLATING, 445 Broad St., Newark 2, N. J.

WANTED—Polishing and plating foreman to supervise 6 experienced polishers and train new ones—good pay and working conditions—growing company Cleveland area. Reply to Box Jy8, PLATING, 445 Broad St., Newark 2, N. J.

SITUATION WANTED—Plating superintendent available. Over 54 consecutive years experience in rhodium, chromium, nickel, silver, gold, bright nickel, hard chromium, etc. Reply to Box Jy2, PLATING, 445 Broad St., Newark 2, N. J.

WANTED—Plater Chemist by southwestern Michigan producer of die casting and plated ware, employing approximately 60 employees. Applicant must have knowledge of production plating and have ability to handle people. Submit complete education and experience. Reply to Box Jy5, PLATING, 445 Broad St., Newark 2, N. J.

POSITION WANTED—Plating superintendent available; age 38; 2 years college (Chemical Engineering); 18 years plating experience with past 4 as superintendent. Experience includes 3 years hard chrome plating, 5 years electropolishing, 8 years of continuous strip steel plating. Will relocate anywhere. Reply to Box Jy6, PLATING, 445 Broad St., Newark 2, N. J.

PLATER WANTED—Must have experience in silver and gold; steady work; no age limit. Joseph Linn Plating Works, Inc., 2655 6th Ave. South, St. Petersburg, Fla.

AES News

Seyb

Edgar J. Seyb, Jr., was born in Pretty Prairie, Kansas and received his early education there. At Sterling College, Sterling, Kansas, he majored in Chemistry and Physics and received his A.B. degree in 1946. He accomplished a Ph.D. in Inorganic and Physical Chemistry at the University of Kansas in 1950. Dr. Seyb joined the Research Labs of United Chromium, Inc., from the University of Kansas and has been associated continuously with electrodeposition research.

Tulumello

Angelo C. Tulumello was born in New York City and received his early education there and in Pennsylvania before coming to Detroit. He received his High School and Collegiate training in Detroit, obtaining the B.S. degree in Chemistry from the University of Detroit. On graduation, Tulumello joined the research staff of United Chromium, Inc., where he has been employed the past two years. In addition to his research activities, he is continuing his training in the Graduate School of Wayne University.

1954-1955 Membership Campaign Winners

Detroit, Sydney and Wichita have won branch membership honors in their respective divisions in the 1954–1955 fiscal year just ended. This announcement was made recently by the National Office.

Second Vice-President Samuel Heiman, National Membership Chairman, announced that an award of $50 was presented to each at the convention in Cleveland.

"These membership accomplishments don't 'just happen'," said Heiman. "It takes work on the part of branch members. These winners for 1954–1955 are to be commended for their splendid performance. We hope that other branches will emulate their record."

NOTICE

Due to press schedules it was not possible to include names of new editorial board members on contents page of this issue.

Additional convention pictures and news will appear in the August issue.

JOHN H. FEELEY

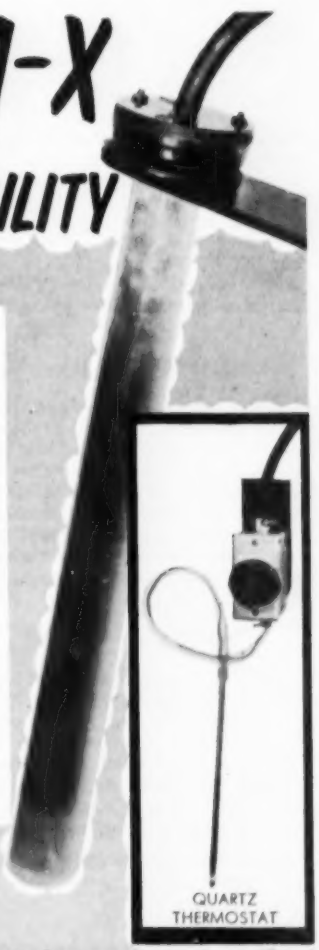
After a lengthy illness, John H. Feeley, President of John H. Feeley and Sons, an old and reputable house of Electroplaters and Silversmiths of Montreal, died on April 30, 1955.

He was founder and first President of the Montreal Branch, AES. He was a past President of the above Society having been elected to that office at Toronto convention in 1928; and in 1939, through his good and tireless endeavour, was made an honorary member of the supreme body of the AES, and will always be remembered for his tireless and devoted efforts to the advancement of electroplating and electroplaters.

new THERM-X

QUARTZ IMMERSION HEATER

FOR RUGGED DEPENDABILITY



Here is an immersion heater with all of the plus features. Constructed with a pure fused quartz shell, it is chemically inert from practically all solvents.

The "THERM-X" heater is available in lengths from 10" to 72", from 100 to 10,000 watts and 115, 230 and 440 volts. Heater supports and protection tubes are also available. Put these newly developed heaters to work for you and be SURE you are using the finest.

"SNAP-ACTION" QUARTZ THERMOSTAT
For Control of Corrosive Liquids and Gases

An outstanding development in heat control. Immune to chemical attack but extremely sensitive to temperature. Finger tip control by adjusting simple dial.

RATING: 22 Amperes at 120-240 volts.
Capillary tubing length 36"

QUARTZ THERMOSTAT

Send today for descriptive literature.

Manufacturers of a complete line of immersion heaters.

N.J. THERMEX COMPANY, INC.
535 BERGEN STREET, HARRISON, N. J.

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News about
COATINGS for METALS
Metallic . . . . . Organic . . . . . Decorative . . . . . Protective

Copper plating process adapts to various needs

Better finishing results from matched plating processes

The first matched set of plating processes for a copper-nickel-chromium plate now exists to help platers reduce finishing expense in several ways.

(1) Three integrated Unichrome process work unusually well together, each deposit contributing to an outstanding finish. (2) Platers have just one call to make for prompt technical help if they should encounter operating trouble. (3) Work-improving and money-saving benefits are realized from the individual processes. For example:

IMPROVED NICKEL

Deposits from Unichrome Bright Nickel prove unusually receptive to the subsequent chromium. Having low internal stress, the deposits resist cracking and give excellent corrosion protection to the base metal. The remarkably stable solution has also reduced addition agent consumption, minimized operating problems.

MORE EFFICIENT CHROMIUM

Wider bright plating range and higher efficiency of Unichrome SRHS Chromium Solutions deliver many benefits. Plating time is often cut more than half, capacity of existing equipment goes up, more intricate parts can be successfully covered, and users often report finishes with better "color."

Contact the nearest office of United Chromium for details.

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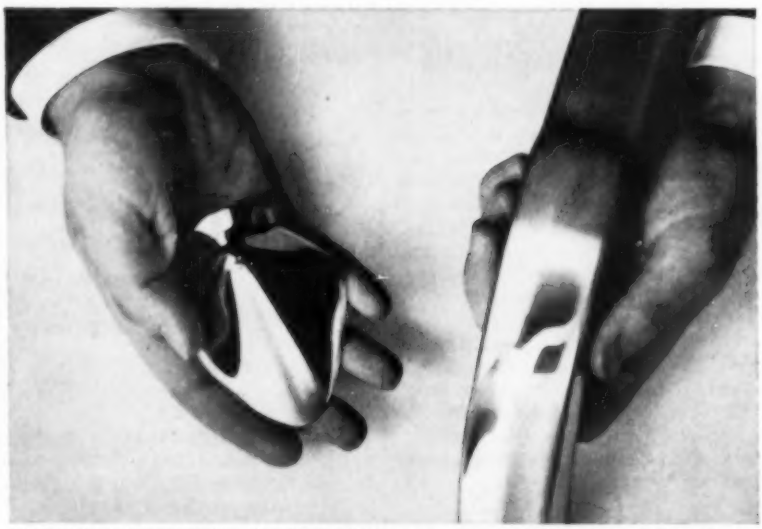
Non-cyanide Unichrome Pyrophosphate Copper Process provides deposits of unusual nature—users benefit



Two of the finishes obtainable with Unichrome Copper. Left: Lustrous plate that needs no buffing prior to bright nickel (Courtesy Royal Plating and Polishing Co., Inc., Newark, N. J.). Right: Satin deposit (upper portion of steel part) that buffs fast and easy to a high color (shown on lower portion of part).

The Unichrome Pyrophosphate Copper Process can be controlled to suit a number of production needs exactly. Newly perfected addition agents, when added to the basic bath, alter the deposit without detracting from its time-proved features.

TO BUFF OR NOT TO BUFF

With one agent, a lustrous deposit is produced which can eliminate buffing. With another, a satin finish is produced which is ideal for buffing—permitting buffing of the free-flowing, ductile copper rather than base metal or subsequent nickel plate.

SMOOTHNESS IS BASIC

Whether used with or without the addition agents, Unichrome Copper deposits are noted for their essential smoothness. In addition, the plating bath has good leveling action, and produces unusually fine grained deposits.

EXTRA BONUS

The Unichrome Pyrophosphate Copper solution contains no cyanide. Its use therefore minimizes the cyanide disposal problem of the plant. As one user recently put it, "a pyrophosphate-type copper solution was selected because of its wide brightness range and because it does not present a serious waste disposal problem."

COMPATIBLE DEPOSITS

Unichrome Copper contributes also to better and more economical copper-nickel-chromium finishing. Its deposit proves ideally receptive for nickel plating, avoiding passivity problems and need for activation treatments.

Send for detailed information.

Branch News

BRIDGEPORT

Capering "Bunny-Hoppers"

Due to the closely scheduled activities of our sister branches, it was decided not to conduct a business meeting and educational meeting of the Bridgeport branch during the month of May. We did, however, hold our annual Spring Dinner Dance on Saturday, May 21, in the delightful surroundings of the Fairfield Inn in Fairfield, Conn. Upwards of fifty members and guests were present to enjoy the excellent cuisine of "Rudy" and dance to the melodic strains of "Carmen" and his combo. One of the features of the evening was the dancing of the "Bunny Hop"; a caper in which everyone participated and seemed to enjoy immensely. The terpsichorean talents displayed by some of our members would have caused Fred Astaire to turn green with envy had he been present. Although the attendance at the affair was small and not as anticipated, the success of the party was attested to by the fact that everyone was present when Home Sweet Home was played to send us on our various ways.

BOB PARKER,
Secretary

BUFFALO

July Picnic Announced at May Meeting

Dr. C. J. Wernlund of E. I. DuPont deNemours & Co. Electrochemicals Department gave a very interesting discussion on "A New Versatile Improvement in Cyanide Copper Plating." His discussion was well received. After a lengthy question and answer period he was given a vote of thanks by the branch.

One application for membership was received and referred to the board of managers.

There were two visitors—**Allen Feder** of Bell Aircraft Corp., and **Frank Baldwin** of S. A. Day Mfg. Co.

Joseph Ruff reported that all preparations have been made for the picnic July 30 at the Kendall Club on Chautauqua Lake, N. Y. ERIC G. SAMPSON, JR.,
Secretary

CAPITOL DISTRICT

New Officers Installed

On May 2, 1955, the Capitol District branch held its regular meeting at the Circle Inn, Lathams, N. Y. Forty-five members and guests attended dinner and the technical and business session which followed.

James Stevens introduced the guest speaker, **Myer Shacat,** New England District Manager of United Chromium, Inc., whose topic was "Chromium Plating." Shacat clearly explained the advantages of the Unichrome SRHS bath and then, by the aid of slides, gave actual comparative results. A very interesting question and answer period followed the timely talk.

The high light of the evening was the presentation of the branch's Permanent Charter by the AES Executive Secretary, **P. Peter Kovatis.** (See May issue.)

Chester Klimek installed **John Green** as treasurer and **Herb James** as a 2-year member of the board of managers. At the April meeting, the following were installed as 1955 officers: President, **Paul D. Callahan;** 1st Vice-President, **Joseph G. Donadio;** 2nd Vice-President, **Leonard Brightman;** Secretary, **Charles Schenk, Jr.;** Board of Managers, **F. A. Infield, Ray Dunlevy, Peter Greco.**

During the course of the business meeting, P. Peter Kovatis answered many questions regarding the AES research program and also elaborated on the advantages of becoming a sustaining member.

CHARLES SCHENK, JR.,
Secretary

CENTRAL MICHIGAN

Scott Speaks on Ge Rectifiers

The May meeting of the Central Michigan branch was held at the Meadowlark Inn in Jackson, Mich., on the evening of May 10.

This was a dinner meeting sponsored by the Udylite Corporation of Detroit.

The speaker for the evening, **Richard Scott,** Electrical Engineer for Udylite, took as his subject the use of Germanium Rectifiers in the plating process. Scott pointed out that the Germanium Rectifier is one of the newest developments in d-c power supply for plating operations. Scott also pointed out that Germanium Rectifiers are smaller than other type rectifiers for comparable output and they are also more efficient.

A film "Fishing in Michigan" was shown through the courtesy of the Michigan Conservation Department.

The Central Michigan branch AES wishes to extend its sincere appreciation to the Udylite Corporation for the interesting program.

R. W. BOOS,
Publicity

CHICAGO

Technical Sessions End

With the summer now in full dress and vacation schedules beginning to contribute to absenteeism, a surprising number of the members of Chicago branch turned out to listen to the guest speaker of the evening, **William Radtke** of Smoothex, Inc., discuss the subject of "Bright Copper Plating" with a view to its applications. His presentation, nicely complemented by the showing of a number of 35 mm slides, was well received. Though most members have had considerable experience with other bright deposits of one sort or another, only a few have had experience in producing truly bright (lustrous) copper. As a result there was an active question period following the talk.

Due to unavoidable absences, two members of the panel of experts were held over from the May to the June meeting. The June panel consisted of: **Gene Gryglas**—Cinch Manufacturing Company; **Klem Petrosius**—Superior Plating Works; **Ken Goodpasture**—Admiral Corporation.

The knowledge of the above experts ranged from general plating processes through the finishing of automobile hardware, and various radio and electronic components. They gave very capable responses to all questions.

After reports from various committees, reminders of the Annual Convention to be held in Cleveland this month, and after all current fish stories had been put to rest, regular operations of the branch were suspended for the summer. Business meetings will be held as usual during July and August, and technical sessions will be resumed in September.

JEROME KUDERNA,
Publicity Chairman

CLEVELAND

Final Meeting

The final regular meeting of the season of the Cleveland branch was held at the Carter Hotel on Friday, May 6.

The session was called to order by President **Lupien,** who immediately turned the meeting over to Librarian **Mort Van Loan,** who introduced our speaker of the evening, **R. V. VandenBerg,** of the Aluminum Co. of America. VandenBerg's subject was "Plating and Anodizing of Aluminum and Aluminum Alloys." The subject was very thoroughly covered by a good selection of slides and a lively question and answer program immediately following the illustrated lecture.

Cochairman of the National Industrial Finishing Exposition, **Charles Ott,** gave a brief "rundown" on the final arrangements for the Cleveland Convention, and we have been assured of a well coordinated schedule of events.

The following applicants were elected to membership in the local branch: **Theodore E. Betz,** R. O. Hull Co.; **Chas. R. Austin,** Bechtel-McLaughlin Co.; **Eugene G. Huth,** Heil Process Equip. Co.; **James S. Krejci,** Platers Supply Co. In addition, **C. Luther Fuelling** was received as a transfer member from the Philadelphia branch.

President Lupien closed the meeting at 10:30 P.M. in favor of the usual Social Hour and refreshment period sponsored through the courtesy of the Harshaw Chemical Co. M. VAN LOAN, JR.,
Librarian

Branch News

COLUMBUS

Nate Koslin President

The regular May meeting and annual banquet of the Columbus branch, AES, was held at Cenci's Rathskeller on Friday, May 6.

After an excellent dinner President **Bill Schickner** called the business meeting to order. **George Skelly,** picnic chairman, reported that the picnic would be held at Y Park on Saturday, July 23. **Walter Denney,** acting nominating committee chairman, explained the ballot used and reasons therefore. President Schickner and the members expressed their thanks to the outgoing officers for their efforts during the past year. **Bill Safranek,** Tri-State committee chairman, thanked his committee for a job well done on the recent Tri-State Meeting at Columbus. **Harry Moore,** Tri-State treasurer, reported that there were about 470 reservations, $725.00 in donations and a profit of $750.00 from the Tri-State Meeting in Columbus.

Schickner reported that **Larry Noll** was resigning from AES because he was moving to the West Coast and would no longer be active in the plating field. Since Larry Noll was a member of the Permanent Tri-State committee, President Elect **Nate Koslin** will appoint a replacement.

President Schickner then presented the officers and delegates for the year 1955–56. These are as follows: President, **Nate Koslin;** 1st Vice-President, **John Soderberg;** 2nd Vice-President, **Rudolf Skriletz;** Secretary-Treasurer, **Michael Farr, Jr.;** Librarian, **Harry Moore;** Board of Managers, **Bill Schickner.**

John Beach proposed to separate the office of secretary-treasurer into its components so as not to overburden one man. After some discussion concerning methods for doing this, Secretary-Treasurer Farr asked to be relieved of the duties of Treasurer. A motion was made by **Bill Neill** and amended by Harry Moore that a treasurer be elected at this meeting. This motion was seconded and unanimously carried. **Bill Hespenheide** was nominated for the office of treasurer. There being no other nominations, the nominations were closed. A motion was made by John Beach that the secretary be instructed to cast a unanimous ballot for Bill Hespenheide. This motion was seconded and carried, and Bill Hespenheide was declared as the Columbus Branch Treasurer for 1955–56.

Critchfield invited Columbus branch members to the Cincinnati branch stag picnic to be held on June 4.

President Elect Koslin thanked the membership for their expression of confidence and promised his best efforts for the coming year.

Bill Neill then presented the speaker of the evening, **Peters** of the Process Engineering Company of Schofield, Ill., who presented an excellent talk on sulfamate nickel. A lively question and answer session ensued.

MICHAEL FARR, JR.,
Secretary

DAYTON

New Officers Hear Talk on New Process

The Dayton branch held its regular May meeting at the Biltmore Hotel with Chairman **John Easton** presiding. Thirty-seven members and friends were present. This being election night, the following were elected to serve for the coming year: President, **Ralph Collins;** 1st Vice-President, **Robert Ruleff;** 2nd Vice-President, **Holle Leuchauer;** Secretary, **Richard Clinchens;** Treasurer, **Jack V. Baker;** Librarian, **Bennie Cohen;** Board of Managers, **John Easton, Fred Bauch, Julius Teres.**

Librarian Holle Leuchauer introduced **O. R. Jackson,** assistant district manager of the Metal Finishing Div., Turco Products, Inc. Jackson substituted for **Archie Beard** who could not attend. The paper presented was "Chemical Milling." This subject is very new, having been developed only 1½ years ago at North American Aviation Co. Turco Products was named as the licensee to do the de-

Imperwite
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TANK HEATERS

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Branch News

velopment work on the process. It has been used extensively in the fabrication of aircraft parts to supplement mechanical milling and in many cases to allow designs of parts that could be made by no other method. Most work has been done on aluminum but experimentation is continuing on other metals such as steels, stainless, titanium and others. Many samples were shown that brought out the wide range of possibilities for such a process.

After the meeting we were treated to refreshments by Wagner Bros., Inc. and their local representatives **Bill Your** and **Dick Evans,** both of Cincinnati.

R. M. Clinehens,
Secretary

GRAND RAPIDS

Final Meeting

An excellent turn-out was recorded for the last seasonal meeting of the Grand Rapids branch on May 13. The meeting, an annual stag affair, was held in the Wolverine Room of the Rowe Hotel.

A cocktail hour preceded the dinner of steak, fish or shrimp. The group was then both baffled and entertained by **Earl Ray** who displayed unusual proficiency in the art of sleight of hand.

President **Perry Burnham** then brought the business meeting to order. Two applicants were accepted as new members—**Clifford Day** of Saranac Manufacturing Company and **Bernard L. Matz** of the J. C. Miller Division of Hanson-Van Winkle-Munning Corporation.

President Burnham announced plans for holding the 1956 Branch Annual Banquet and Educational Session on February 11, 1956. He appointed the following committee: Chairman, **Robert Blackford;** Tickets, **Jack Hanney;** Favors, **Carl Green,** Jack Hanney, **Richard Watson;** Entertainment, **Paul Waalks.**

Delegates and alternates elected to the National Convention were: Richard Watson, Perry Burnham, **Donald Schantz, Rex MacKercher** and **Tony Preston.**

After the meeting was adjourned the members enjoyed refreshments provided through the courtesy of **"Dusty" Rhoades** of the Northwest Chemical Company.

Thomas C. Henner,
Publicity Chairman

INDIANAPOLIS

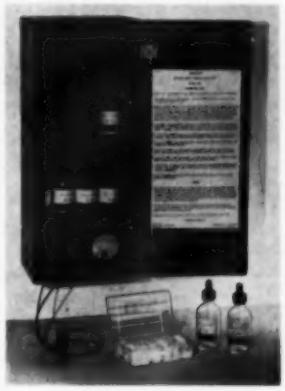
FBI Man Sees New Officers Elected

The program of the May 4 meeting resulted in a most interesting one when **Leonard Blaylock,** special agent of the Federal Bureau of Investigation in charge of the state of Indiana was our guest speaker. Blaylock asked for 20 minutes to present his program but when he had finished, 60 minutes had slipped away. He was a very fluent speaker and everyone present was fascinated by his presenting facts about his work. He told how the department of FBI works with the T-men, narcotics department, postal inspectors, etc. Intrastate violation of the law brings in the FBI and also when $5,000 or more has been swindled or embezzled, or any robbery or embezzlement of federal reserve bank or those banks with federal protection. He also gave us an example of the "Con" game. Blaylock stated that the FBI never recommends when they are investigating, they merely investigate and report. They give no personal opinions.

The business meeting followed with 23 members present. The usual form of business opened the meeting with reports of the secretary and treasurer. The balance from the dinner dance was $168.97. A letter of thanks is to be sent to the three speakers of our annual educational session.

One new member was voted into the branch on a motion by **Ed Bruck** and seconded by **Jack Vaughan.** He is **Myron E. Browning** of Indianapolis who is associated with the Western Electric Company.

Discussion followed about instructing the delegates as to the national convention election. Vaughan moved that the branch instruct the delegates as far as the first ballot. This was seconded by **Quentin**



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Branch News

Shockley and was voted by a show of hands. The motion was carried.

Herb Kennedy reported on information about the Tri-State organization. Shockley moved that the committee members, who are Kennedy and **Frank Hartwig** along with the new board of managers go over the by-laws of the Tri-State organization. This was seconded by **Lew Reynolds** and carried.

The annual election of officers followed and as the present secretary's name was on the ballot for treasurer, Shockley nominated said secretary for re-election. It was suggested that the nominees for secretary and treasurer be combined with the highest vote go to the secretary and second highest vote to the treasurer. As there were no other nominations from the floor, the result was as follows: President, **Herbert Kennedy;** 1st Vice-President, **Bert Hawbee;** 2nd Vice-President, **John M. Hood;** Secretary, **Edna Rohrabaugh;** Librarian, **Frederick Anderson;** Board of Managers, **Robert VanHouten, John E. Vaughan, Marshal Whitehurst, Elmer Lundberg.**

The out-going president, **Elmer Lundberg,** asked the president-elect to say a few words and Kennedy asked for the cooperation of all the members for the coming year.

Refreshments were served and the meeting adjourned at 10:20 P.M.

EDNA ROHRABAUGH,
Secretary

LOS ANGELES

All Out for the 1960 Convention

The May meeting was held at the Rodger Young with 78 members and guests in attendance. After the Sergeant-at-Arms, **Pete Esten,** introduced the visitors and the secretary and treasurer, reports were read and approved; the membership chairman introduced three new candidates. Seven new members were initiated into the branch: **Burton G. Adams, Fernando Alvarez, Everett W. Elgin, James E. Hodges, James M. Routen, George W. Slomin** and **William T. Wilson.** This was the largest group initiated this year.

The big topic of discussion for the evening was the possibility of the Los Angeles branch getting the National Convention in 1960. A lot of enthusiasm has been shown regarding this possibility and the delegates have been instructed to do whatever is necessary to convince the American Electroplaters that sunny Southern California is the ideal spot to hold the 1960 National Convention.

Our speaker for the evening was **T. P. Rogers** of the American Chemical Paint Co. who presented an interesting paper on "Chemical Films for Aluminum."

Quite a few members reported that they had received cards from **Don Bedwell** who with Mrs. Bedwell is enjoying a well earned vacation in Honolulu, Hawaii.

GEORGE J. HETZ,
Secretary

LOUISVILLE

New Officers Elected

The regular monthly meeting of the Louisville branch was held Thursday, April 21, 1955, at Kapfhammer's Party House, with a dinner served. Vice-President **K. E. Reifsteck** opened the business and open meeting with 22 members and guests present.

Arthur A. Oertel, of the roster committee, reported that progress was being made on the membership roster and will be available to all of the members at the September meeting.

Technical Sessions Chairman **Stanley J. Beyer** reported that **A. H. Kirkpatrick,** of the F. B. Stevens, Inc., Detroit, Mich., will be the May speaker and the subject will be "Engineering in the Plating Room." Also, a General Electric Company movie entitled "Principles of Electricity" will be shown.

Application for membership: **William F. Chapman,** Nashville 7, Tenn.—active member.

A letter arrived from **R. E. Varner,**

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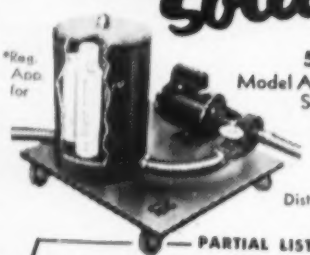

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Branch News

president of the Pittsburgh branch, requesting our support in selecting Pittsburgh, Pa., as the convention city for the year 1960.

A letter reached us from the Detroit branch, requesting our support to elect **Herb Head** as a third vice-president at the convention in Cleveland in June 1955.

Arthur A. Oertel submitted his resignation as a permanent delegate to the Tri-State Regional Meeting and is replaced by **James R. Smith.**

Richard G. Marshall gave us a report of the Tri-State Regional Meeting which was held on Saturday, March 26 at the Deshler Hilton in Columbus, Ohio. Those who attended from Louisville were R. G. Marshall, **J. R. Smith, J. S. Houston,** and **Harold Peters.** In view of the bad weather that was encountered, there was success in the meeting.

The newly elected officers for the Louisville branch AES for the 1955 to 1956 fiscal year are as follows: President, **William W. Francis;** 1st Vice-President, **Kenneth C. Reifsteck;** 2nd Vice-President, **Stanley J. Beyer;** Secretary-Treasurer, **Joseph G. Sterling;** Librarian, **John S. Houston;** Sergeant-at-Arms, **John Kehrer;** Board of Managers, **Arthur A. Oertel, P. H. Pate, John W. Scholl.**

Delegates and alternate delegates elected to the National Convention to be held in Cleveland, Ohio, from June 20 to 23, inclusive, are as follows: Delegates, **J. G. Sterling, Stanley J. Beyer, K. C. Reifsteck;** Alternate Delegates, **J. S. Houston, Arthur A. Oertel, Harold G. Peters.**

The meeting was then turned over to Librarian Stanley J. Beyer who introduced the speaker, **J. D. Little** of the McGean Chemical Company, Cleveland, Ohio. Little talked on "Trouble Shooting in Bright Nickel Plating." Considerable discussion followed and Little was given a rising vote of thanks for a very interesting talk.

J. G. Sterling,
Secretary-Treasurer

NEW HAVEN

New Officers in New Haven

The regular meeting was held at the Mason Laboratory, Yale University on March 8. President **Edward Busby** gave a report on plans for the New England Regional which will be held in the Hotel Statler, Hartford, Conn., on May 14. An application for membership was received from **Edward Seitz.** President Busby appointed a nominating committee headed by **John Barry.**

Technical Chairman, John Barry, then introduced **Arthur Kohler,** Technical Director of the Frederick Gumm Chemical Company, who spoke on "Barrel Burnishing." He covered this subject thoroughly from both a theoretical and practical standpoint and explained the action that takes place on commonly used metals when using various types and sizes of burnishing media. The unusually long question and answer period gave evidence that the subject was of interest to a large segment of the membership.

The meeting was brought to a close with a door prize drawing donated by **Hank Kellner** of Lea Manufacturing.

A regular April meeting was called to Order by President Edward Busby on April 12 in the Mason Laboratory, Yale University.

Something new will be tried for the final meeting to be held on Friday, May 20. A combination business and social meeting will wind up a very successful year. The place will be announced and all members will be notified by mail.

The nominating committee submitted its recommendations for the 1955–56 term and the following were elected by a unanimous vote: President, **William K. Murray;** Vice-President, **Austin P. Jackson;** Secretary-Treasurer, **Bernard J. Gaffney;** Librarian, **Leo Roberti;** Assistant Librarian, **Charles A. Kuster;** Sergeant-at-Arms, **Frederick E. Allen;** Historian, **Walter T. Lynch;** Board of Managers, **Edward F. Busby, George A. Tracchio, John M. Barry;** Delegates, **Dr. Henry L. Kellner, Walter T. Lynch, Harry R.**

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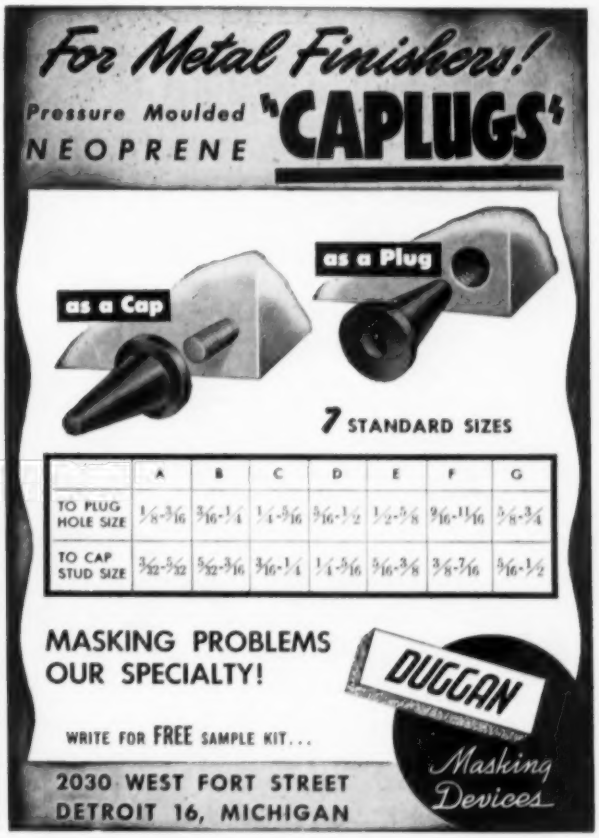

	A	B	C	D	E	F	G
TO PLUG HOLE SIZE	1/8-3/16	3/16-1/4	1/4-5/16	5/16-1/2	1/2-5/8	9/16-11/16	5/8-3/4
TO CAP STUD SIZE	3/32-5/32	5/32-3/16	3/16-1/4	1/4-5/16	5/16-3/8	3/8-7/16	5/16-1/2

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Branch News

Taylor; Alternates, **Lawrence J. Durney, William E. Bridgett, Charles A. Kuster.**

A past president pin was awarded to Edward Busby by newly elected Vice-President Austin Jackson. Newly elected President William Murray was unable to attend because of business commitments.

Technical Chairman **John J. Martin** then introduced the speaker of the evening, **Mason Glover,** President of Glover Coating Company, Inc., who spoke on Tank Linings and Coatings. Glover is considered an expert on this subject and his talk was both technical and interesting. His manner of speaking, his command of language and his willingness to share his experience contributed to a memorable evening.

The meeting was brought to a close with a door prize drawing donated by **Al Ferguson** of MacDermid Incorporated.

Program Preferences Listed

The May 20 meeting was held at the Colonial House, Hamden, Conn., where the branch sponsored an Old Timer's and Past Presidents' Night.

The new president, **Bill Murray,** succeeded in combining both business and pleasure with the result that Librarian **Leo Roberti** is off to a good start in arranging the educational program for the coming year.

The assembled membership has indicated its preference for a program embracing a combination of the following topics: Silver Plating, Problems of Adhesion, Basis of Cleaning and Cleaners, Corrosion Testing, Chrome Plating, Copper and Brass Plating, Metal Stripping, Plating Metallurgy, Plating Room Layout, Finishing of Light Metals, Stop off Methods and Materials.

The past regional was discussed and Bill Murray reminded the members that New Haven will be the host branch in 1956.

B. J. Gaffney,
Secretary-Treasurer

PHILADELPHIA

Ladies Nite in Philly

The regular meeting on May 27 was Ladies Nite. Held in the lecture hall of the Franklin Institute, it was attended by about 40 ladies and gentlemen.

A motion authorizing the appropriation of funds to cover delegates' expenses for the Cleveland Convention was approved. Also approved was a motion that the branch pay for the bus transportation to the Fairless Works for the trip through the Works sponsored by the branch on June 7. Three new members were admitted.

The speaker was **Ezra Blount,** editor of "Products Finishing," who showed color films of Japan, taken several years ago. They were very informative and interesting.

Following Blount's presentation, a nice snack of Danish pastry, coffee and ice cream was served in the Dairy Dell through the kindness of the Reynolds Company.

I. Wm. Marcovitch,
Secretary

PITTSBURGH

Rousingly Successful Banquet Before Final Meeting

The annual Ladies Night Banquet was held in April by the Pittsburgh branch at the Churchill Valley Country Club.

Approximately 250 enjoyed an excellent prime ribs of beef dinner and a wonderful show staged by about 20 performers from the Westinghouse Electric Corporation amateur group. Proceeds from all their performances go to charity. It was the best entertainment we had seen in many a year.

Leo J. Schmitt, Sr. was presented with an honorary membership in recognition of his long service and expert counseling since the early days of the branch.

A most enjoyable evening was concluded with dancing, beverages, favors for the ladies, and valuable door prizes.

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Branch News

A rousingly successful banquet, one of the best in many years and the credit goes to Cochairmen **Harry Flister** and **Ken Hittle** and their committee of **Rex Goldbach, Bill Pizoli,** and **Bill Wilson.**

The final meeting of the season for the Pittsburgh branch was held in the Lafayette Room of the Sherwyn Hotel with steak as the main course.

The business for the evening consisted of one new application for membership, **R. S. Vaupel;** a financial report on the Ladies Night Banquet by W. Pizoli that the branch broke even; election of a new board of managers consisting of R. Goldbach, **E. Washburn** and **R. Varner,** and the installation of new officers by the "Old Pro" Leo Schmitt.

The day of reckoning arrived for 2nd Vice-President **Myron Ceresa** who promised prizes for those with the best attendance for the year last fall and he certainly was true to his word. The following prizes were given by the Electroplating Projects Department, Westinghouse Electric Corporation, through the efforts of Myron. Perfect Attendance—Pocket Book-Key case combination and Zippo lighter: Myron Ceresa, **Fred Dixon,** K. Hittle, **Art Koupe.** For missing only one meeting—Zippo lighter: **James Crain, Bill Musmanno,** Rex Goldbach, Harry Flister, **Herb Schram,** Bob Varner, **Henry Schaltenbrand.** For missing only two meetings—Automatic lead pencil: **W. Bohman, Glade Bowman, Albert Hart, Loren McOmber, Eugene Momeyer,** Bill Pizoli, **Russell Reynolds, David Porter, Charles Churchill, F. W. Stockton, E. B. Washburn,** Bill Wilson.

Our speaker for the evening was **B. G. "Birdie" Daw** of LaSalco Inc., who talked on "What Happens in a Plating Barrel." Emphasizing how much to put in a plating barrel and explaining how to calculate this factor he brought out that most barrel plating troubles result from over-loading and he brought along his own movies to clinch the argument.

After a short pause for refreshments and the drawing for the door prize "Birdie" had a ready answer for some real tough questions. The door prize, a Westinghouse table model radio presented by Harry Flister of Wyandotte Chemicals Corporation was won by Herb Schram.

HERB SCHRAM,
Secretary

PORTLAND

Folkestad of 3-M on Coated Abrasives

Our regular meeting was held on May 3 at Berg's Chalet, and we are pleased to report that we had a very fine turnout. At least part of the reason for the good attendance was the fact that our speaker for the evening was **Thor Folkestad** of Minnesota Mining and Manufacturing Company, who showed us two films on coated abrasives. Folkestad is one of the outstanding men in the Northwest on coated abrasives, and we were pleased that we could see these films and ask him questions related to the use of coated abrasives for the metal working industry.

KEN HUMPHREY,
Secretary-Treasurer

PROVIDENCE-ATTLEBORO

New Officers Nominated

The Providence-Attleboro branch held their monthly meeting on Monday, April 18, at the Engineering Society Building, Providence, R. I.

The Nominating Committee, under the leadership of **Cliff Healey,** chairman, submitted for election: President, **Pierre B. Lonsberry;** Vice-President, **Eric G. Shearstone;** Treasurer, **Daniel O. Turner;** Secretary, **Frederick L. Sherman;** Librarian, **Leslie Ferguson;** and Board of Managers, **William Matthew.**

Delegates to National Convention: **Dr. E. A. Parker, John Clarner, Pierre B. Lonsberry.** Alternate Delegates: **Dr. Anton Mohrnheim, George Gibbs, Leslie Ferguson.**

Following the branch business, **Wm. K. Murray,** of Enthone Inc., gave an interesting and instructive presentation entitled

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Branch News

"Adhesion of Plate to Base Metal." The information and a demonstration was directed toward rust removal and preplate surface preparation of ferrous metals.

F. L. SHERMAN,
Secretary

ROCHESTER
'55 Officers Reelected

The May meeting of the Rochester branch was called to order at 6:30 P.M., May 16, at the Standard Brewing Company, Rochester, N. Y., by President **Ed Wallin.**

The program consisted of a buffet supper followed by a short business meeting.

There was a discussion regarding the plating course offered at the Rochester Institute of Technology this past year, and several suggestions were made as to improvement of the course.

The branch was notified of **William Tucker's** appointment to the National Education System for the Society.

The election of officers was held, with the reelection of the 1955 slate for another year.

Entertainment was planned and provided by Librarian **Frank Beuckman.** A rising vote of thanks was given Frank Beuckman and his committee for the fine job they did in arranging the meeting, preparation and dinner, as well as **Don Blum** for arranging the meeting place, the Standard Brewing Company.

Announcement of the Buffalo picnic was made and plans for a bus trip by the branch were discussed.

The meeting was adjourned in favor of cards, games and movies.

FREDERICK L. JOHNSON,
Secretary

SAGINAW VALLEY
Pontiac's Ni Plating Plant Visited

Saginaw Valley branch held their May meeting at the Pontiac Motor Division, of GM. A plant tour was conducted through their nickel plating installation.

Dinner was served to 94 members and guests in their plant cafeteria.

Librarian **Frank Asselin** introduced **Jack Doyle,** Plating Superintendent of Pontiac Motors. He gave a few brief remarks about their plating setup.

ALFRED KNIGHT,
Recording Secretary

ST. LOUIS
Officers Installed

The regular monthly meeting of the branch was held on May 11 at York Hotel with 26 members present for dinner and 30 for the business meeting which followed.

The main order of business was the election of delegates to the National Convention. The following members were elected as Delegates: **Robert Coulson, Otto Dingeldein, A. P. Julius.**

These officers having been elected at the previous meeting were installed in the following offices: President, **Edward Hunleth;** 1st Vice-President, **Robert Coulson;** 2nd Vice-President, **Craig McAlister;** Secretary-Treasurer, **Ward Kelly;** Librarian, **Richard Nyquist;** Sergeant-at-Arms, **Theo. Soukup.**

After the business meeting **B. G. Daw** of Lasalco Inc. showed three reels of colored film taken at various points along the Atlantic Coast where he had taken his first voyage. His commentary, along with the pictures, proved to be very entertaining. After a rising vote of thanks for Daw's interesting show, the meeting was adjourned.

WARD W. KELLY,
Secretary-Treasurer

SEATTLE-PUGET SOUND
Final Meeting

The May meeting of the Seattle-Puget Sound branch was held at the Stewart Hotel on May 10. Approximately 35 members, guests and wives, enjoyed a talk on plating and chemical finishing of magnesium by **Charles Kimmel** of the Dow Chemical Company, Test Service and Development Division. Kimmel was

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Branch News

assisted in showing slides by **Donald J. Legassey,** of the Dow Chemical Company, Seattle office.

A short business meeting was held before Kimmel spoke. The new president outlined his ideas and plans for the coming year.

The Seattle-Puget Sound branch will be in recess during June, July and August, unless a program of outstanding interest is available.

HELEN ARCHIBALD,
Secretary

SOUTHERN TIER

On Cleaning Aluminum

The Southern Tier branch of the AES held a meeting at the Ah-Wa-Ga Hotel, Owego, N. Y., on May 17. The meeting was called to order by President **Rood.** Guests present were introduced as follows: **Baltzell,** from Oakite Products; **Moore,** from Frederick Gumm Products. **Stefanski** introduced the speaker for the evening, **Arthur S. Kohler,** Technical Director of Frederick Gumm Products, who used for his subject, Aluminum Finishing. His discussion covered cleaning aluminum that contains less than ½ per cent silicon: 1—Scratch brush or steel wool cleaning, 2—Dipping in cold solvents, 3—Emulsion type cleaners, 4—Hot chloronated solvents, 5—Nonetch cleaners, 6—Etch type cleaners. He also discussed spot welding and burnishing as well as removal of welding flux and buffing compounds. Question and answer period followed.

ROGER WHEELER,
Secretary

SPRINGFIELD

New Officers Installed

The May meeting of the Springfield branch was held at the Mount View Club in Willimansett, Mass.

Reading of all reports was suspended for the evening as per the request of President **Philip Sanders.**

The meeting was turned over to **Edward Mahar,** the installation officer. Mahar explained the responsibility to each officer, of his duty, and then the following were sworn in: President **Robert Girard**, 1st Vice-President **Roger Heroux,** 2nd Vice-President **Charles Griffin, Jr.,** Treasurer **G. Harold Mongeau,** Secretary **Henry L. Heissfeld,** and Librarian **Edward Mahar.** The Board of Managers installed are: **Philip Sanders, Anthony Horta, John Costigan, R. Minor Frost,** and **Edward Dupuis.** Chairman of Research and Finance is **John E. Costigan.**

After the ceremony, the members enjoyed a good lobster or steak dinner with all the trimmings, thanks to Edward Dupuis' efforts. This was followed by a social period and a club specialty floor show. A good time was had by all.

HENRY L. HEISSFELD,
Secretary

TWIN CITY

Past Presidents Honored

The May meeting which was held at the Covered Wagon in Minneapolis commemorated the past presidents of the Twin City branch. The following is a list of the individuals who have served the branch in the office of president: **E. H. Lindeman** 1944–45, **A. T. Leonard** 1947–48, **Dr. F. Ireland** 1948–49, **Clifford Bowman** 1949–50, **Albert A. Joiner** (deceased) 1950–51, **D. Wray Schorr** 1951–52, **Jerome M. Weller** 1952–53, **Paul R. Hesse** 1953–54, **George Reed** 1954–55, **B. J. Rosenthal,** who was master of ceremonies for the event, presented each past president with a beautiful blue and white anodized plaque mounted on a walnut backing.

The plaque for Albert A. Joiner was accepted by his two sons. It is the plan to have samples of the plaques which were manufactured by Hiawatha Metalcraft on display at the National Convention. **Robert L. Buckley,** who has been secretary-treasurer of the branch since its inception, was presented with a movie camera for his years of faithful service.

A social session followed the meeting as **R. J. Rahr** of the Mitchell-Bradford Chemical Co. who was to address the group on "Blackening of Metals" was unable to attend due to a death in his immediate family that day.

WATERBURY

New Officers, New Sustaining Members

The April meeting was held on Thursday, April 14, 1955 in the Colonial Room of the Hotel Elton. President **Perry Sloane** opened the meeting and gave a run-down of the branch accomplishments during his term of office. He expressed the hope that the combination business meeting and technical session that was started this year be continued.

Frank Eddy installed the officers for the coming year, 1955–1956. The new officers are: President, **Joseph Petrocelli;** 1st Vice-President, **George Dubpernell;** 2nd Vice-President, **Theodore Voyda;** Secretary-Treasurer, **Spencer L. Henn;** Assistant Secretary, **Albert Griffith;** Librarian, **Edward J. Garland;** Assistant Librarian, **William P. Innes;** Publicity Director, **Frank Tirendi;** Board of Managers, **Perry Sloane, Frank Eddy, Edward V. Collins.**

At the conclusion of installation, the meeting was turned over to the new President, Joseph Petrocelli, who commented on the remarks made by Past President Perry Sloane as to keeping the business and technical meetings intact. He felt that such a combination would allow greater expression by the membership.

Toastmaster **Bill Starr** presented pins to the Past Presidents of the Waterbury branch. This proved very interesting as each Past President had something to say about what they remembered most during their term of office.

Ellsworth Candee reported on new Sustaining Members. They are: American Electro Products, Inc.; Eastern Electroplating Co., Inc.; American Brass Company; Summit Finishing Company; Crane Equipment & Supply Co., Inc.; Harper Leader, Inc.; Whyco Chromium Co., Inc.

F. TIRENDI,
Publicity Director

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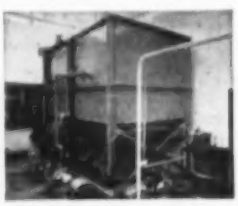

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Elections

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BRIDGEPORT: Lurance French, Frank Hightower, Paul Iannucci, Albin Jocis, Wm. Popp, Harry Simon

BUFFALO: Harry W. Critzer, Wilber C. Fullerton, Fred O. Goeckel, Wallace A. Keefe, J. Raymond Kilroy, Donald R. Pembridge, Wallace C. L. Rosdahl

CINCINNATI: Edgar H. Maus

CLEVELAND: Charles F. Bunting, Reginald V. Gaggino, Herbert Koenig, John Palik, Jr., Richard B. Parks

DETROIT: Edward R. Bartos, Bernard M. Baur, Daniel J. Borodin, Walter D. Brooks, R. P. Ganchan, R. H. Glezen, Marvin A. Kozak, Arthur W. Kurz, Jr., Carl D. MacPherson, Jr., Roscoe M. Mallen, Bernard A. Matrille, Earl McDonald, George R. McLeod, George C. Spencer, Lewis Spern, Arthur N. Ulrich, Roy Warren

HOUSTON: Wayne H. Waters

LOUISVILLE: W. P. Radcliff, N. D. Shack

MILWAUKEE: Samuel Antcliffe, Daniel Bartz, Elton Larson, Norman Rowe, Ernest Schultz

NEWARK: Joseph Azzolino, John R. Fiorito, Edward Herzig, Raymond J. Litterio, Daniel A. Marino, Salvatore A. Mollica, James J. Shyne

NEW YORK: Harold Banks, Martin Bard, Wm. E. Bryan, Charles G. Buehtman, Gerald Epner, Ralph E. Fuller, William M. Hess, George K. Kelly, Eraldo Laddomada, Frank LaMantia, William R. Phillips, Gerardo Ritacco, Stanley L. Siegel, Martin H. Smith, George A. Viola

PHILADELPHIA: William H. Brown, Franklin H. Krienitz, Peter J. Lestician, Frank Zagari

ROCKFORD: Gene F. Kerwins

SAGINAW VALLEY: John Wazny

SEATTLE-PUGET SOUND: Alexander MacRae, George E. Millard, Harold A. Richards, Albert Smolarick

SOUTHEASTERN: Joel D. Pelham, Robert H. Probert

SOUTHERN TIER: William J. Collins, Donald C. Peters, Theodore J. Swenson

SPRINGFIELD: Walter J. Dyber

SYRACUSE: William M. Robinson

TOLEDO: Joseph A. Wagner

TORONTO: A. D. Black, Neville C. Davies, Alan J. Pett, Leslie W. Piddington, Leslie R. Pyle, Stanley Stern, W. J. N. Throop, N. Weatherston

TWIN CITY: Thomas J. Ballentine, Robert G. Smith

WESTERN ONTARIO: D. R. Mainland

MEMBER-AT-LARGE: Leon Ades, Paris, France; H. I. Badawi, Gamalia, Cairo, Egypt; James K. Gore, Los Alamos, New Mexico; B. J. Jones, Lancashire, England; Alphonse-Lucien Pahud, Geneva, Switzerland; George Rourke, Coventry, Warwickshire, England; Edgar M. Spenceley, Hunslet, Leeds, England

Reinstatements

BUFFALO: W. H. Beck

DETROIT: Webster B. Knight, Jr.

HOUSTON: Ralph A. Marz

NEW YORK: P. Hudec

SAGINAW VALLEY: Francis J. Shannon

TOLEDO: Ronald Bechtel, A. Suckley

WATERBURY: Leslie F. Heene

Transfers

CINCINNATI: L. A. Critchfield to Dayton

DALLAS-FT. WORTH: Elwood R. Rinehart from Buffalo

DAYTON: L. A. Critchfield from Cincinnati

DETROIT: Chester Borlet to Grand Rapids; Robert I. Carlson to Seattle-Puget Sound

SEATTLE-PUGET SOUND: William P. Foley from Los Angeles; Robert I. Carlson from Detroit

SYRACUSE: Carl J. Byrns, Jr., to Grand Rapids

WESTERN ONTARIO: A. W. Johnson from Toronto

Resignations

ADELAIDE: W. R. Williams

ALLENTOWN-READING: Walter Trainer

BRIDGEPORT: E. Phillips, F. W. Rock

DALLAS-FT. WORTH: W. D. Hinchcliffe, Maurice A. Zito

DETROIT: Frederic DeWitt

HARTFORD: David B. Lowney

PHILADELPHIA: Joseph C. Sharbaugh

SAGINAW VALLEY: J. M. Small

SPRINGFIELD: J. Fournier, C. Simpson

Suspensions

HARTFORD: Roger C. Quimby

NEWARK: Louis M. Brown, Cataldo Chiarelli, Samuel Dlin, Harry Dolgin, Robert Edwards, Lester M. Glick, Michael Millardi, Robert E. Moore, William E. Mullen, Bennie Pedota, Willard Reiley, Richard J. Relick, William G. Schmidt, William A. Sterner, Peter Vitarelli

NEW YORK: Arthur J. Abrams, Thomas E. Anderson, Leonard Bowman, William M. Cartwright, Peter Catalanotto, Leonard F. Cuthie, Harold A. Dunleavy, Alfred F. Ehrensberger, Philip H. Eisenberg, David Garfinkel, Milton Gelfand, Peter J. Hoffman, Arthur E. Jacobs, Joseph Kleinman, Norman Kuperschmid, Albert Leibowitz, Murray Paley, Charles Pep, Lino R. Rosa, Sidney Rosofsky, Walter P. Schilling, Sidney Shein, Simon Silverman, Anthony J. Vivona, James H. von Rohr

SEATTLE-PUGET SOUND: Ralph J. Simacik, Edward Stebor

SOUTHEASTERN: C. L. Estes

SYRACUSE: Clinton S. Burhans, Edward Morgan

Deaths

DAYTON: William H. Hartzell

HARTFORD: J. L. Post

NEW YORK: Edward Cicio

Index to Advertisers

ACME MANUFACTURING COMPANY, INC. 872
Rex Dye
ALLIED INDUSTRIES CO. 926
Claude E. Whipple
ALLIED RESEARCH PRODUCTS, INC. 854
Emery Advertising Corp.
ALSOP ENGINEERING CORP. 836
AUTOMOTIVE RUBBER CO., INC. 849
Zelsy & Associates

BACON FELT COMPANY 868
F. P. Walther, Jr., Associates
M. E. BAKER COMPANY 844
BART-MESSING CORPORATION 833
Bass and Company
BEAM-KNODEL COMPANY 916
BEHR-MANNING CORPORATION (NORTON CO. DIV.) 839
Peterson & Kempner, Inc.
BELKE MANUFACTURING CO. 861
Allbright Associates
BENRUS WATCH CO. 909
Equity Adv.
BETTER FINISHES & COATINGS, INC. 838
James J. McMahon, Inc.

CHANDEYSSON ELECTRIC COMPANY 845
Oakleigh R. French & Associates
CHASE BUFF COMPANY 918
THE CHEMICAL CORPORATION 844,908
Wm. B. Remington
CHEMSTEEL CONSTRUCTION CO., INC. 916
Smith, Taylor & Jenkins Inc.
CLEVELAND PROCESS COMPANY 866
Malcolm Advertising Agency

DUGGAN MASKING DEVICES 919
A. R. Brash & Sons

ENTHONE, INCORPORATED 823
Hugh H. Graham & Associates

FALLS INDUSTRIES 916
Scheel Advertising Agency
FEDERATED METALS DIVISION, AMERICAN SMELTING & REFINING COMPANY 848
John Mather Lupton Company, Inc.

GENERAL ELECTRIC COMPANY 864-865
G. M. Basford Company
GLO-QUARTZ ELECTRIC HEATER CO. INC. 903
FREDERICK GUMM CHEMICAL COMPANY, INC. ..... Inside Front Cover
Schniedenbach Studios

HANSON-VAN WINKLE-MUNNING COMPANY ..... 867 and Back Cover
O. S. Tyson & Company, Inc.
HARRISON & COMPANY 923
THE HARSHAW CHEMICAL COMPANY 826
R. O. HULL & COMPANY, INC. 831
Ralph M. French Advertisers

KOCOUR COMPANY 917
DeCasseres & Associates
JOSEPH B. KUSHNER 923

LEA MANUFACTURING CO. 893
Sanger-Funnell, Inc.
LEA-RONAL, INC. 894
Sanger-Funnell, Inc.
LEA MANUFACTURING COMPANY OF MICHIGAN 920
Sanger-Funnell, Inc.
CHARLES F. L'HOMMEDIEU & SONS 842

MAC DERMID, INCORPORATED ..... Inside Back Cover
Jackson-Hall Company
THE MEAKER COMPANY 846
Armstrong Advertising Agency
MICHIGAN BUFF COMPANY, INC. 922
MICHIGAN CHROME & CHEMICAL CO. 869
Karl G. Behr Advertising Agency
MINNESOTA MINING & MFG. CO. 828
Batten, Barton, Durstine & Osborn

NEW JERSEY THERMEX CO., INC. 913
Ray Ellis Advertising
NORTON COMPANY, ABRASIVE DIVISION 847
James Thomas Chirurg Company

OAKITE PRODUCTS, INCORPORATED 909
Rickard and Company

PAPESCH & KOLSTAD, INC. 926
POWERS REGULATOR CO. 852
Symonds, MacKenzie and Co.
PROMAT DIV., POOR AND COMPANY 870
Russell T. Gray, Inc.
PYROSIL, INC. 919
Koehl, Landis and Landry, Inc.

SCHAFFNER MANUFACTURING CO., INC. 851
Advance Advertising Company
E. E. SEELEY COMPANY, INC. 922
SELLERS ENGINEERING COMPANY 871
McCarty Company
SEL-REX PRECIOUS METALS, INC. 837
Bass & Co.
SETHCO MANUFACTURING COMPANY 918
Harry Hurst Advertising
THE SEYMOUR MFG. COMPANY 832
R. H. Young and Associates
SPARKLER MANUFACTURING CO. 843
Kreicker & Meloan, Inc.
FREDERIC B. STEVENS, INC. 824,924
Zarker Advertising Company
STORTS WELDING COMPANY, INC. 829
Harold S. Card
GEORGE A. STUTZ MFG. COMPANY 853,907
Sander Rodkin Advertising Agency
SULPHUR PRODUCTS CO., INC. 920

TECHNIC, INC. 921
Geo. T. Metcalf Co.
TRUE BRITE CHEMICAL PRODUCTS COMPANY 921

THE UDYLITE CORPORATION 834-835
Zarker Advertising Company
UNIT PROCESS ASSEMBLIES, INC. 918
Glassner & Associates
UNITED CHROMIUM, INC. 914
Rickard & Company
UNITED PLATERS, INC. 917
Patton-Gille-Belthaire, Inc.

WESTINGHOUSE ELECTRIC CORP. 874-875
Fuller and Smith and Ross
WYANDOTTE CHEMICALS CORPORATION 841
Brooke, Smith, French, and Dorrance

ZIALITE CORPORATION 922

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445 Broad Street, Newark 2, N. J.

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Lehigh University, Bethlehem, Pa.

Secretary.....P. PETER KOVATIS
445 Broad Street, Newark 2, N. J.

AES BRANCHES (Changes only)

LANCASTER meets second Friday of each month at 8 P.M. September, December and April meetings are held at Hanover, York and Harrisburg, respectively; all other meetings at the Old Mill Inn, Lancaster, Pa. Secretary-treasurer, Curvin Miller, Hill Electroplating, E. Mason St., York, Pa. Research finance committee chairman, Harry Hovis, 2418 Columbia Ave., Lancaster, Pa.

MILWAUKEE meets first Friday of each month in the East Room, Hotel Ambassador. Secretary-treasurer, Clifford A. Peters, 4124 W. Southland Drive, Milwaukee, Wis. Research finance committee chairman, Les Diveley, 2936 N. 84th St., Milwaukee 11, Wis.

PROVIDENCE-ATTLEBORO meets third Monday of each month in Providence Engineering Society Hall, 195 Angell St., Providence, R.I. Secretary, F. L. Sherman, 17 Hillsdale Drive, Cranston, R.I. Research finance committee chairman, P. B. Lonsbury, 78 North Ave., Attleboro, Mass.

SAN ANTONIO meets third Monday of each month at De-Winne's Belgium Inn, 3119 W. Commerce, San Antonio, Texas at 7 P.M. Secretary-treasurer, T. H. Collard, 442 Pilgrim Drive, San Antonio, Texas.

TORONTO meets second Friday of each month in Royal York Hotel. Dinner 6:30 P.M.; meeting 8:30 P.M. Secretary-treasurer, E. F. Hutt, 15 Emily St., Toronto, Ontario. Research finance committee chairman, K. Wells, 370 Victoria Ave., Toronto, Ontario, Canada.

Future Meetings

August 22-23—Stanford Research Institute and National Industrial Conference Board, Sheraton-Palace, San Francisco, Calif.

September 6-17—National Machine Tool Builders' Association, International Amphitheatre, Chicago, Ill.

September 6-17—Production Engineering Show to be held in conjunction with the Machine Tool Show, Navy Pier, Chicago, Ill.

September 6-17—Coliseum Machinery Show (formerly Metalworking Machinery & Equipment Exposition), Chicago Coliseum, Chicago, Ill.

September 8-9—Chemical Institute of Canada, Physical Chemistry Division Conference, Montreal, Canada.

September 11-16—American Chemical Society, National Meeting, Minneapolis, Minn.

September 12-16—Illuminating Engineering Society, National Technical Conference, Cleveland, Ohio.

September 12-16—Instrument Society of America, 10th Annual Instrument Conference and Exhibit, Shrine Exposition Hall and Auditorium, Los Angeles, Calif.

September 14-16—Porcelain Enamel Institute, 17th Annual Shop Practice Forum, Ohio State University, Columbus, Ohio.

September 19-22—American Institute of Mining and Metallurgical Engineers, Industrial Minerals Division, Asheville, N. C.

September 25-28—American Institute of Chemical Engineering, Regional Meeting, Lake Placid Club, Lake Placid, N. Y.

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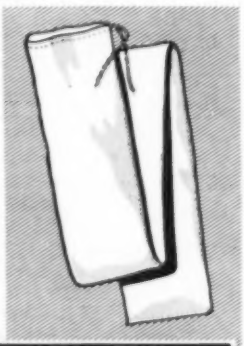

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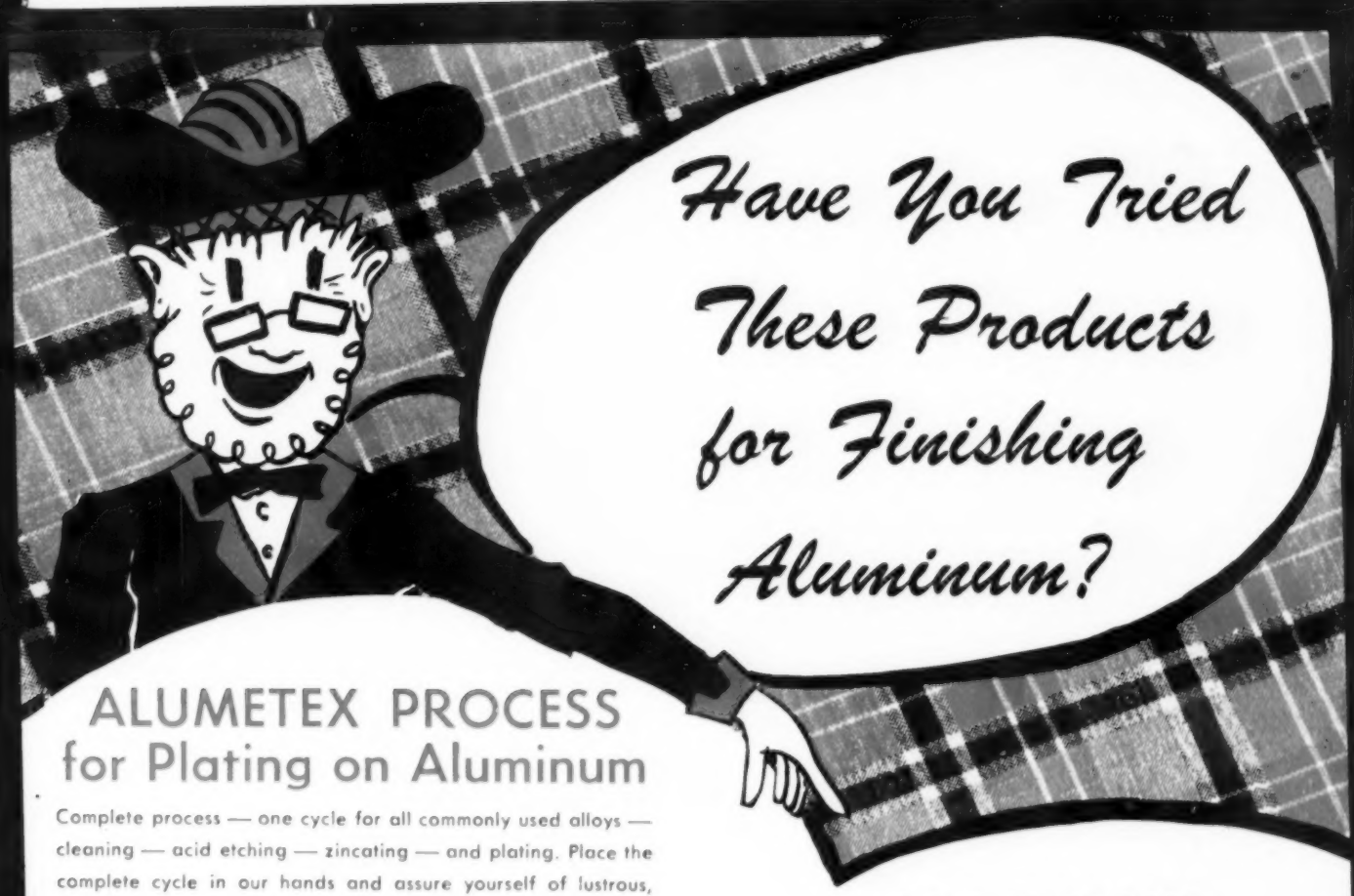

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